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UNITED STATES DEPARTMENT OF AGRICULTURE

REPORT ON

C.W.A. NATIONAL SURVEY OF RURAL ELECTRIFICATION

By

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and

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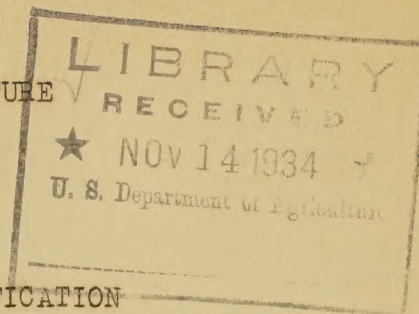
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Organization. This survey was undertaken as a supplement to the C.W.A. Farm Housing Survey. Housing survey personnel was used for administration and for obtaining data in the field. State supervision was provided without cost by the Land Grant Colleges through their Extension Divisions and Departments of Agricultural Engineering. Data to be obtained were decided upon jointly by representatives of the Bureaus of Home Economics and Agricultural Engineering, Dr. F. S. Warner, Head, Division of Research, National Power Survey, and Prof. Chas. E. Seitz, of Virginia Polytechnic Institute and Past-President of the American Society of Agricultural Engineers.

Purpose. The purposes of the survey, other than to give employment, were to obtain information supplemental to data from the Housing Survey, census, and other sources, relative to the present availability of electric service to farmers, its use, and the possibilities of extending service to additional farms. Other purposes were to foster local interest in improved farm living conditions and in rural line construction which would give employment to workers. The data collected are to be made available to the Public Works Administration and to any organization which can use them for the benefit of the public.

Extent of the Survey. Twenty-five states were included in the survey. The states selected were those in which supervisory personnel was available. Work was started in most of the states about March 15 and ended officially on May 28. The areas covered in each state varied from one township to a partial survey of 42 counties (see map, Fig. 1). The average number of counties per state was 4.5. The summary given in this report includes data from 19 states. Reports for those have not been received and the data from three others were insufficient to tabulate. The surveys are being continued to get additional information in Illinois, Iowa, Massachusetts, Maryland, North Carolina, Oregon, Virginia, and Washington.

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THE HISTORY OF THE UNITED STATES

OF THE

UNITED STATES OF AMERICA

BY

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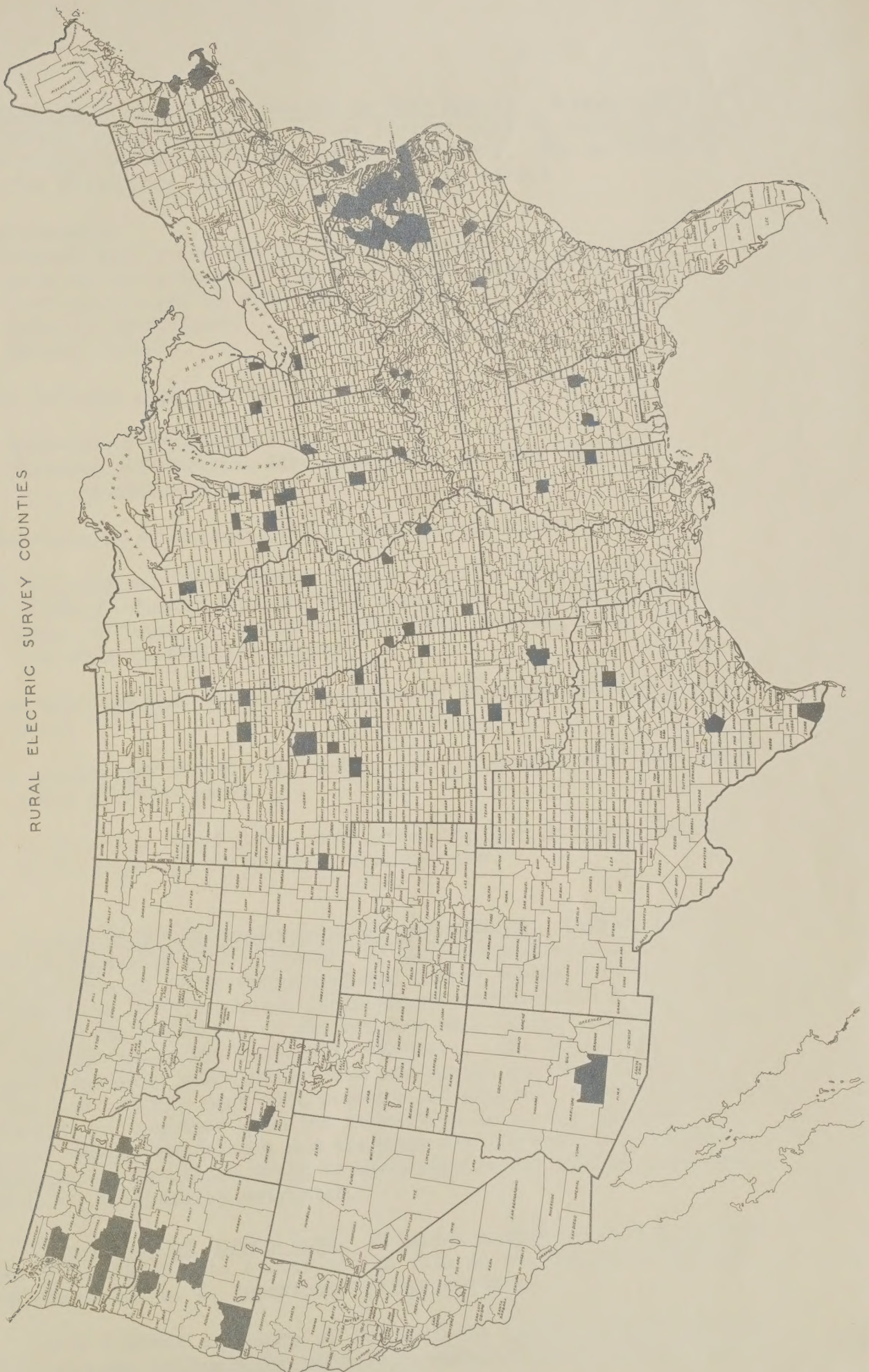
NEW YORK:

THE UNIVERSITY OF CHICAGO PRESS, 1892.
This history of the United States is a complete
and up-to-date work, covering the entire
period from the first settlement of the
continent to the present time. It is written
in a clear and concise style, and is
adapted for use in schools and colleges.
The authors are both distinguished
scholars, and their work is the result
of many years of research and study.
The book is well illustrated, and
contains many valuable facts and
figures. It is a work of great
authority, and is highly recommended
for all who wish to know the
history of the United States.

The history of the United States is a
subject of great interest and importance.
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NOV 27 1934



RURAL ELECTRIC SURVEY COUNTIES

Fig. 1

Additional Data Not Presented in This Report. A major part of the information submitted by the states applies only to specific localities and cannot be tabulated in a national summary. The information includes the following: (Not complete for every state)

State maps showing

- Transmission lines and generating stations
- Existing and proposed rural distribution lines
- Territory served by different utilities
- Types of agriculture
- Forested areas.

County or township maps showing:

- Existing distribution lines
- Proposed distribution line extensions and locations of possible customers

Brief descriptions of existing rural distribution lines

Lists of the proposed distribution line extensions in the order of estimated feasibility and with descriptions of the territory, types of farms, construction problems, possible load, and available electricity supply.

Rate schedules and line extension policies of companies serving rural areas.

Specific examples of monthly and yearly power consumption of different types of rural users.

Data on cooperative owned lines, laws affecting cooperatives, interest of local groups in electric service, etc.

Reliability and Completeness of Information. This survey is intended primarily to give a picture of the possibilities of extending electric service to farms throughout the United States. It includes sufficient areas of wide enough geographical distribution to give an indication of the situation in the country as a whole. Figures pertaining to specific areas are reasonably accurate. The speed with which this survey was made and compiled did not permit careful checking in all cases. The county maps with present and proposed distribution lines shown in colors, together with the supporting data, are adequate for making preliminary appraisals and programs for the territory involved. More detailed examinations would be necessary before making construction cost and feasibility estimates.

Disposition of Survey Data. Original copies of survey reports and maps submitted by the states are on file in the Bureau of Agricultural Engineering, U. S. Department of Agriculture.

Table I gives a summary of the data for the U. S. and includes actual totals and averages for only those sections of 19 states from which data were available on July 1, 1934.

TABLE I

Summary of data available July 1, 1934 from Rural Electrification Survey.*

Total number of farms in the U. S. (1930): 6,288,648

Total number of farms in the area surveyed: 114,137

Data from Rural Electrification Survey		Existing		Proposed Extensions	
Farm customers.....		13,953		13,706	
Total rural customers.....		20,751		16,340	
Total miles of distribution lines serving rural customers.....		5,074.5		4,179	
Rural customers per mile.....		4.09		3.91	
Number of proposed extensions.....					
		No.	Kwh. per yr.	No.	Kwh. per yr.
Different types of farms, and average power used per year:					
Dairy.....		5,036	986	4,801	772
Poultry.....		896	838	562	880
General.....		7,931	1,289	7,904	980
Other rural customers.....		7,084	1,245	2,762	700

		White		Non-white		
Total		Owner	Non-owner	Owner	Non-owner	
Data from Farm Housing Survey						
Number of farm houses in area surveyed	99,011	45,390	41,331	1,965	10,325	
Average number of rooms in house.....	5.85	6.4	5.75	4.26	3.37	
Average number of regular occupants...	4.46	4.2	4.56	3.98	4.48	
Central station electric service.....	12,675	8,677	3,894	34	70	
Home electric plants.....	5,916	4,286	1,553	12	70	
Power line needed.....	16,362	8,909	7,065	94	294	
Average number of miles to power line for all farms not connected.....	3.84	3.33	3.16	6.47	3.69	
Equipment:						
Electric pump - have now.....	4,646	3,515	1,122	3	6	
Mechanical refrigerator - have now.....	2,898	2,267	612	11	8	
" " - need.....	4,083	2,064	1,922	30	67	
Electric stove - have now.....	1,421	1,178	241	2		
" " - need.....	882	463	389	17	13	
With:						
Would invest in:						
\$500	Lighting system.....	6,258	3,301	2,601	61	295
\$250	" "	2,738	1,447	1,152	23	116
\$500	Power line.....	5,677	3,027	2,403	102	145
\$250	" "	2,663	1,470	1,100	33	60

* States included: Alabama, Arizona, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, Ohio, Oklahoma, South Dakota, Texas, Wisconsin.

SURVEY DATAExplanations of Terms, Sources of Information, Etc.

Proposed Extensions include lines for which applications for service have been made to power companies; also lines to serve other farms where a desire for service exists and there is reasonable possibility of serving; and farms whose proximity, type of agriculture, prosperity, ownership, or other attributes indicated a possible kwh. consumption per mile of line adequate to support service. Engineers estimates of "possibilities" vary. No attempt was made to set up an exact measure for a possible customer.

Farm Customers include all farm and other customers now served by rural lines or who would share in the cost of or be served by proposed rural lines.

Types of Customers and Power Consumption. These data are estimated from actual counts in the territory or from power company data in most cases. Power consumption in some states was obtained from meter book records and in others it was estimated from a few typical farms. "General" farms include all single enterprise as well as multi-crop farms which could not be classified as "dairy" or "poultry".

Other Rural Customers include schools, churches, stores, rural residents not farmers, service stations, garages, grist mills, canneries, pea viners, dehydrators, cotton gins, community or company irrigation pumps, railway pumping stations, quarries, gravel pits, and others.

Housing Survey Data were obtained by lady enumerators who visited each occupied farm house and interviewed the occupant or owner.

The Number of Farm Houses in the District is seldom the same as the number of farms because of tenant houses, abandoned houses, more than one family per house, etc. Only houses in use were listed.

Central Station Electric Service. These figures do not always check with the number of farm or rural customers listed. In some cases the service is at the pumping plant or barn and not at the house; in others the survey figures may not have covered exactly the same areas. Time has not permitted checking all of the discrepancies. The actual figures submitted are presented without attempting to adjust them.

Power Line Needed is listed only when answered affirmatively on the housing survey blanks.

The Average Number of Miles to a Power Line for All Farms Not Connected is a relative figure only. It has little value except as a general indication of the proximity of electric service to farms not served. The figure was obtained by dividing the sum of the miles of each farm to the nearest power line by the number of farms. An average distance of one mile may mean that it would take five miles of line to serve five customers, or all might be served by one mile of line. Large figures indicate that the farms are either far apart or a long way from service.

With \$500, Would Invest in Lighting System. Tabulations are answers to the question: If you had \$500 (\$250) for improving your home, what would you spend it for? "Lighting system" and "Power line" were two of twenty items listed on the questionnaire.

Fig. 1 shows counties in which the C.W.A. rural electric survey was made.

Tables 2 to 20 inclusive, give the data collected in the rural-electrification and farm housing surveys, by States.

TABLE II

ALABAMA

Total number of farms in the state (1930): 257,395
 Total number of farms in the area surveyed: 7,687
 Counties included: Perry and Tallapoosa.

Data from Rural Electrification Survey	Existing		Proposed Extensions	
Farm customers.....	2		557	
Total rural customers.....	37		689	
Total miles of distribution lines serving rural customers.....	20.06		159.6	
Rural customers per mile.....	1.84		4.3	
Number of proposed extensions.....			14	
	No.	Kwh. per yr.	No.	Kwh. per yr.
Different types of farms, and average power used per year:				
Dairy.....	-	-	31	1200
Poultry.....	1	240	7	240
General.....	1	2640	287	772
Other rural customers.....	1	2000	92	2416

Data from Farm Housing Survey	Total	White		Non-white	
		Owner	Non-owner	Owner	Non-owner
Number of farm houses in area surveyed	7379	1393	1886	514	3582
Average number of rooms in house.....	3.65	5.01	3.96	3.7	2.94
Average number of regular occupants...	5.00	5.02	5.11	5.07	5.02
Central station electric service.....	113	61	46	3	3
Home electric plants.....	50	45	4	0	1
Power line needed.....	225	94	114	5	12
Average number of miles to power line for all farms not connected.....	5.77	6.02	5.62	6.1	5.64
Equipment:					
Electric pump - have now.....					
Mechanical refrigerator - have now..	14	8	6	-	-
" - need.....	95	52	40	2	1
Electric stove - have now.....	6	6			
" - need.....	9	4	5		
With: Would invest in:					
\$500 Lighting system.....	85	64	16	2	3
\$250 " 	18	14	2	1	1
\$500 Power line.....	37	22	12	1	2
\$250 " 	16	8	8		
\$100 " 	12	5	6		1

ADDITIONAL SURVEY DATA FOR ALABAMA

State Supervisor: J. B. Wilson, Alabama Polytechnic Institute, Auburn.

Perry County: J. H. Ellard

Tallapoosa County: Dewitt Hicks

Data includes:

Public Service Commission Rules and Regulations for Rural Service.

Rural Rates of Alabama Power Co.

Survey tabulations by townships.

Descriptions of existing transmission lines with locations on county maps.

" " rural distribution " " " " " "

List of proposed new rural line extensions in the order of feasibility
with descriptions of lines needed, line estimates, and estimates
of number of customers of different classes.

County maps with present and proposed lines located.

State map showing transmission lines as of 1930.

Possible supporting industries in rural territory include cotton gins,
grist mills, gasoline stations, and stores.

Line construction is on highways with some timber clearing necessary,
all earth excavation, and no line connection charges.

TABLE III

PINAL COUNTY, ARIZONA
(Estimated from partial survey.)

Total number of farms in the state (1930): 14,444
 Total number of farms in the area surveyed: 1,008
 Counties included: Pinal County

<u>Data from Rural Electrification Survey</u>	Existing	Proposed Extensions
Farm customers.....	127	140
Total rural customers.....	140	152
Total miles of distribution lines serving rural customers.....	187	41
Rural customers per mile.....	0.75	3.72
Number of proposed extensions.....		
	No. Kwh. per yr.	No. Kwh. per yr.
Different types of farms, and average power used per year:		
Dairy.....	- -	12 2,677
Poultry.....		
General.....	70 36,000	23 17,000
Other rural customers.....	12 1,862	12 900

	Total	White		Non-white	
		Owner	Non-owner	Owner	Non-owner
<u>Data from Farm Housing Survey</u>					
Number of farm houses in area surveyed	840	389	291	43	117
Average number of rooms in house.....	3.31	3.53	3.19	3.14	2.77
Average number of regular occupants...	4.22	3.43	4.10	5.28	6.09
Central station electric service.....	105	59	39	-	7
Home electric plants.....	34	24	7	-	3
Power line needed.....					
Average number of miles to power line for all farms not connected.....	5.73	7.35	2.76	7.93	6.51
Equipment:					
Electric pump - have now.....	73	42	27	1	3
Mechanical refrigerator - have now..	199	171	24	1	3
" " - need.....	318	85	145	24	64
Electric stove - have now.....	22	17	5	-	-
" " - need.....	96	45	44	1	6
Wanted:					
Lighting system.....	102	50	43	2	7
Power line.....	75	40	33	-	2

ADDITIONAL SURVEY DATA FOR ARIZONA

State Supervisor: G. E. P. Smith, University of Arizona, Tucson.
Pinal County: Robert H. Carson.

The tabular rural electrification survey data for Pinal County is an estimate based on a detailed survey of McDowell school district. Totals for the county were arrived at by multiplying the McDowell figures by 105/9, the ratio of farms having central station service in the county to those in the district as given in the housing survey.

The narrative report contains general information on the agriculture of the state, sources of power, and distribution of power. One of the chief producers of power is the Salt River Valley Water Users Association. Power is used mainly for irrigation pumping and is distributed generally by consumer owned Electrical Districts. Some of the districts are in bad financial condition.

Distribution is at 11,000 volts where distances between farms is great. Separate transformers are required for domestic service, the irrigation transformers being disconnected to avoid losses when not in use. Mostly 25 cycle lines with 16 - 20 poles per mile.

TABLE IV

IDAHO

Total number of farms in the state (1930): 41,674

Total number of farms in the area surveyed:

Counties included: Jerome, Gooding, and Latah.

<u>Data from Rural Electrification Survey</u>		Existing		Proposed Extensions	
Farm customers.....		744		183	
Total rural customers.....		772		496	
Total miles of distribution lines serving					
rural customers.....		109.89		158.77	
Rural customers per mile.....		5.1*		3.14	
Number of proposed extensions.....				28	
		No.	Kwh.	No.	Kwh.
			per yr.		per yr.
Different types of farms, and average					
power used per year:					
Dairy.....		2	1,284		
Poultry.....		1	1,284		
General.....		751	1,545	494	1,430
Other rural customers.....		18	277,964	2	1,200
		Total	White	Non-white	
			Owner	Non-owner	Owner Non-owner
<u>Data from Farm Housing Survey</u>					
Number of farm houses in area surveyed	2,023	1,154	868	1	
Average number of rooms in house.....	4.97	5.2	4.84	8	
Average number of regular occupants...	4.29	4.1	4.56	5	
Central station electric service.....	261	141	119	1	
Home electric plants.....	67	56	11		
Power line needed.....	569	298	271		
Average number of miles to power line					
for all farms not connected.....	2.86	1.7	2.68		
Equipment:					
Electric pump - have now.....	142	56	22	1	
Mechanical refrigerator - have now..	42	34	7	1	
" " - need.....	400	256	143	1	
Electric stove - have now.....	143	105	38		
" " - need.....	131	81	49	1	
With:	Would invest in:				
\$500	Lighting system.....	242	138	104	
\$250	" "	92	48	44	
\$500	Power line.....	157	99	58	
\$250	" "	39	24	15	

* Jerome and Latah Counties only.

ADDITIONAL SURVEY DATA FOR IDAHO

State Supervisor: Hobart Beresford, University of Idaho, Moscow.
 Field Engineers: P. G. Means
 Robt. E. Alworth
 Office Engineer: Fred M. Simonton,

The report contains a large amount of well organized statistical data on rural development by power company districts, including descriptions of lines by service centers, total kwh. sold, average kwh. per customer, average cost per kwh. to rural users, number of customers per mile, and percent of farms served. Also rated lists of proposed line extensions from service centers, giving number of customers, miles of line, and estimated annual consumption per line. The names, addresses, distance to power line, and ownership of tenant farms is given for all customers on proposed extensions. The prospective customers were interviewed and the number on each line who did not want service are also listed.

Farms in the Jerome-Gooding district of the Idaho Power Co. are 57 percent served. The average consumption is 1620 kwh. per year, and average cost of service is 3.65¢ per kwh. Eleven irrigation service customers in the district used an average of 454,033 kwh. per year at a cost of 0.72¢ per kwh.

Data on the U. S. Minidoka Irrigation Project shows 1294 out of 2384 farms served. Distribution is largely through farmer owned mutual companies. Nineteen of these companies with the kilowatt-hours purchased and price paid are tabulated. The average wholesale price for 1,021,771 kwh. used was 1.789¢ per kwh. Distribution systems on the project are listed and described.

Most power companies of the state use farm labor for digging holes and farm teams for hauling where available. They also sell energy at a wholesale rate of about 2¢ per kwh. to farmer groups who build and maintain their own lines.

A list of all power companies in the state with miles of rural lines, customers per mile, number of farm and rural customers, and kilowatt-hour consumption is given.

There are 28 pages of farm rate schedules and extension policies applying to the state.

Maps submitted include:

State map showing all generating stations, transmission lines, rural distribution lines, and proposed rural lines.
 District maps showing existing and proposed rural distribution lines and existing and proposed rural customers.
 Township plats with proposed lines plotted.

TABLE V

ILLINOIS

Total number of farms in the state (1930): 214,497
 Total number of farms in the area surveyed: 5,922
 Counties included: McHenry and Champaign.

<u>Data from Rural Electrification Survey</u>	Existing		Proposed Extensions	
Farm customers.....	1,641		838	
Total rural customers.....	3,154		964	
Total miles of distribution lines serving rural customers.....	514.5		228	
Rural customers per mile.....	6.13		4.22	
Number of proposed extensions.....			43	
	No.	Kwh.	No.	Kwh.
		per yr.		per yr.
Different types of farms, and average power used per year:				
Dairy.....	1,104	1,145	500	1,162
Poultry.....	46	861	20	1,002
General.....	491	1,005	318	1,080
Other rural customers.....	1,507	74	123	426

	Total	White Owner	White Non-owner	Non-white Owner	Non-white Non-owner
Data from Farm Housing Survey					
Number of farm houses in area surveyed	5,092	1,920	3,169	1	2
Average number of rooms in house.....	7.86	7.61	7.02	9	9
Average number of regular occupants...	4.55	4.35	4.96	6	4
Central station electric service.....	1,132	584	548	-	-
Home electric plants.....	415	249	166	-	-
Power line needed.....	40	17	23	-	-
Average number of miles to power line for all farms not connected.....				2.3	2.1
Equipment:					
Electric pump - have now.....					
Mechanical refrigerator - have now..	187	112	75	-	-
" - need.....	76	32	44	-	-
Electric stove - have now.....	160	111	49	-	-
" - need.....	3	2	1	-	-
With: Would invest in:					
\$500 Lighting system.....	138	49	89	-	-
\$250 " 	155	39	116	-	-
\$500 Power line.....	255	105	149	-	-
\$250 " 	187	48	139	-	-

ADDITIONAL SURVEY DATA FOR ILLINOIS

State Supervisor: E. W. Lehmann, University of Illinois, Urbana.
 Assistants: Donald R. Vogel, Guy C. Hoover, R. R. Richart, and Miss Olivia Meyer.

The survey was made by personal visits to farms and to power companies and by a power company questionnaire asking for specific data on rural territory. The report contains a large amount of information in tabular form, including:

- Equipment used by customers.
- Farms served, miles of line, energy used per customer and per mile for different companies.
- Kwh. use per farm, and total and unit costs on farms of different sizes. Similar data for non-farm rural users.
- Percent of customers who required private extensions of 4 poles or more from existing lines, by utility companies.
- Rural customer trends in connections and consumptions, 1930-1934, by companies. There has been a small net decrease in number of farm customers and consumption per customer in 1934.
- Educational and promotional work was slackened.
- Rural energy use and costs under different line extension policies.
- Possible customers within 1/4 mile of existing lines, by companies.

Among 300 farmers interviewed, some customers, some not, there was universal desire for electric service. The major deterrent was cost. Five companies out of nine reported increasing farmer interest in the past few months.

Possible supporting rural industries are coal mines, hatcheries, pea viners, drainage pumping, railroad pumping, taverns, schools, greenhouses, gravel pits, elevators, tourist camps, and service stations. The density is reported so slight however, as to have little effect on line extensions.

Line construction involves some tree trimming and some loose rock excavation in certain areas. Descriptions of existing lines in two counties are given.

Proposed extensions are described, rated, and prospective use estimated. Forty-three new extensions are proposed for two counties.

A supplementary report gives the plan of the survey, sample forms used, and rates and line extension policies.

Maps submitted:

- Incomplete map of state showing rural distribution and transmission lines. The map is being completed.
- Maps of McHenry and Champaign Counties showing present and proposed lines and customers.

A project has been submitted to the emergency relief administration for the continuation of this survey in the state.

TABLE VI

INDIANA

Total number of farms in the state (1930): 181,570

Total number of farms in the area surveyed: 4,494

Counties included: LaPorte and Knox.

Data from Rural Electrification Survey		Existing		Proposed Extensions	
Farm customers.....		321		174	
Total rural customers.....		482		198	
Total miles of distribution lines serving rural customers.....		186.18		66.86	
Rural customers per mile.....		2.10		2.96	
Number of proposed extensions.....				13	
Different types of farms, and average power used per year:		No.	Kwh. per yr.	No.	Kwh. per yr.
Dairy.....		49	800	31	600
Poultry.....		15	1,622	1	600
General.....		301	690	113	560
Fruit and vegetable.....		14	3,787		
Grain.....		2	417		
Other rural customers.....		209	1,900	26	772

Data from Farm Housing Survey		Total	White		Non-white	
			Owner	Non-owner	Owner	Non-owner
Number of farm houses in area surveyed	4,273	2,468	1,805			
Average number of rooms in house.....	6.48	6.59	5.94			
Average number of regular occupants...	4.35	4.07	4.8			
Central station electric service.....	511	378	133			
Home electric plants.....	247	183	64			
Power line needed.....	444	245	199			
Average number of miles to power line for all farms not connected.....	2.11	2.15	2.53			
Equipment:						
Electric pump - have now.....	287	223	64			
" " - need.....	160	106	54			
Mechanical refrigerator - have now..	84	60	24			
" " - need.....	182	81	101			
Electric stove - have now.....	97	76	21			
" " - need.....	19	10	9			
With: Would invest in:						
\$500	Lighting system.....	377	213	164		
\$250	" ".....	212	115	97		
\$500	Power line.....	261	203	58		
\$250	" ".....	154	122	32		

ADDITIONAL SURVEY DATA FOR INDIANA

State Supervisor: Truman E. Hienton, Purdue University, Lafayette.
LaPorte County: W. M. Richman
Knox County: Chas. H. Free
Clerk: Vivian Thomas

Data includes:

Maps and descriptions of farming areas in the state, soil types, and locations of dairy, poultry, and pasture areas. In 14 of the 17 counties of the state where more than 25 percent of the farms are electrified, more than a ton of butterfat was sold per 640 acres in 1924.

Table of farms having individual plants and central station service by counties for 1923, 1929, 1930, and 1934. It shows a gradual change from lighting plants to central station service.

Possible supporting industries: Tomato canneries, small coal mines, quarries and gravel pits.

Descriptions of existing transmission and distribution lines in the two counties surveyed.

Descriptions and rating of proposed new distribution lines.

Tabular information for LaPorte and Knox Counties by townships.

Examples of rural rates in the surveyed counties.

TABLE VII

IOWA

Total number of farms in the state (1930): 214,928
 Total number of farms in the area surveyed: 4,589
 Counties included: Benton and Story.

Data from Rural Electrification Survey	Existing		Proposed Extensions	
	No.	Kwh. per yr.	No.	Kwh. per yr.
Farm customers.....	759		512	
Total rural customers.....	813		510	
Total miles of distribution lines serving rural customers.....	447		142	
Rural customers per mile.....	1.82		3.6	
Number of proposed extensions.....			38	
Different types of farms, and average power used per year:				
Dairy.....	1	18,000		
Poultry.....	1	3,400		
General.....	727	592	512	584
Other rural customers.....	46	3,735	8	938

Data from Farm Housing Survey	Total	White		Non-white	
		Owner	Non-owner	Owner	Non-owner
Number of farm houses in area surveyed	4,230	1,662	2,568		
Average number of rooms in house.....	7.1	7.2	7.0		
Average number of regular occupants....	4.4	4.1	4.5		
Central station electric service.....	761	435	326		
Home electric plants.....	564	354	210		
Power line needed.....	260	80	180		
Average number of miles to power line for all farms not connected.....	1.7	1.8	1.6		
Equipment:					
Electric pump - have now.....	481	307	174		
Mechanical refrigerator - have now..	156	107	49		
" - need.....	215	80	135		
Electric stove - have now.....	53	41	12		
" - need.....	23	9	14		
With: Would invest in:					
\$500 Lighting system.....	167	58	109		
\$250 " 	38	14	24		
\$500 Power line.....	316	86	230		
\$250 " 	49	19	30		

ADDITIONAL SURVEY DATA FOR IOWA

State Supervisor: Henry Giese, Iowa State College, Ames.
Benton County: Wm. J. Schuldt
Story County: Louis Graham

The survey is being continued in all counties included in the Farm Housing Survey, including Davis, Fayette, Madison, Mitchell, Shelby, Sioux, Scott, and Webster. Expect to complete July 31, 1934. Interest exists in a long-time program for service to all farms in the state.

Report submitted contains information for Benton and Story Counties as follows:

- Tabular summary for each county.
- Descriptions of present distribution lines.
- Customer classification and kwh. consumption by townships.
- Proposed extensions with possible customers classified and lines rated.
- Rate schedules and extension policies in effect.

Utilities have been receiving more requests for service this year than during the past two years.

Group-owned lines have been discouraged by utilities. Many of them have failed due to poor management. Most of the lines have been taken over by the utilities.

Existing sources of power are adequate for all proposed extensions.

TABLE VIII

KANSAS

Total number of farms in the state (1930): 166,042
 Total number of farms in the area surveyed: 5,908
 Counties included: Franklin and Sedgwick.

Data from Rural Electrification Survey	Existing	Proposed Extensions		
Farm customers.....	879	795		
Total rural customers.....	1,009	840		
Total miles of distribution lines serving rural customers.....	425.25	288.74		
Rural customers per mile.....	2.35	2.9		
Number of proposed extensions.....				
	No.	Kwh. per yr.	No.	Kwh. per yr.
Different types of farms, and average power used per year:				
Dairy.....	61	2,266	46	2,280
Poultry.....	4	7,608	18	7,608
General.....	811	1,008	748	908
Other rural customers.....	131	2,543	45	624

Data from Farm Housing Survey	Total	White Owner	White Non-owner	Non-white Owner	Non-white Non-owner
Number of farm houses in area surveyed	4,796	2,507	2,289		
Average number of rooms in house.....	6.17	6.3	5.98		
Average number of regular occupants.....	4.2	3.95	4.45		
Central station electric service.....	866	589	277		
Home electric plants.....	228	161	67		
Power line needed.....	277	188	89		
Average number of miles to power line for all farms not connected.....	2.08	1.98	2.19		
Equipment:					
Electric pump - have now.....	-	-	-		
Mechanical refrigerator - have now..	186	145	41		
" - need.....	335	201	134		
Electric stove - have now.....	113	97	16		
" - need.....	71	41	30		
With:					
Would invest in:					
\$500 Lighting system.....	209	122	87		
\$250 " 	12	8	4		
\$500 Power line.....	678	339	339		
\$250 " 	49	27	22		

ADDITIONAL SURVEY DATA FOR KANSAS

State Supervisor: F. C. Fenton, Kansas State College, Manhattan
Franklin County: H. A. Grabendike
Sedgwick County: R. J. Hamilton

Report includes:

Description and map showing types of farming in state.

Two charts showing rates and actual costs for power from different companies.

State map giving number of present customers and customers on proposed extensions by counties.

Estimated state statistical summary of rural electrification.

County maps of Franklin and Sedgwick Counties showing present and proposed distribution lines and customers.

There are few supporting industries in Kansas rural territory and power consumption other than on dairy farms is only 50 to 60 kwh. per month. Farmers feel that rates are too high. Farms are too far apart in the western part of the state to justify extensions at present.

TABLE IX

KENTUCKY

Total number of farms in the state (1930): 246,499

Total number of farms in the area surveyed: 6,783

Counties included: Fayette, Hardin, and Shelby.

Data from Rural Electrification Survey	Existing		Proposed Extensions	
Farm customers.....	872		560	
Total rural customers.....	3,419		739	
Total miles of distribution lines serving rural customers.....	226.15		160.85	
Rural customers per mile.....	15.02		4.59	
*Number of proposed extensions.....			*31	
*(Fayette and Shelby Counties only)				
	No.	Kwh. per yr.	No.	Kwh. per yr.
Different types of farms, and average power used per year:				
Dairy.....	78	3,702	76	1,134
Poultry.....	14	608	18	442
General.....	752	1,977	389	2,810
Other rural customers.....	3,033	1,591	152	1,301

	Total	White		Non-white	
		Owner	Non-owner	Owner	Non-owner
Data from Farm Housing Survey					
Number of farm houses in area surveyed	6,304	3,466	2,526	108	204
Average number of rooms in house.....	5.34	5.76	4.21	4.76	4.11
Average number of regular occupants...	4.4	4.21	4.70	4.09	4.87
Central station electric service.....	872	610	241	3	18
Home electric plants.....	212	162	46	4	-
Power line needed.....	936	478	421	13	24
Average number of miles to power line for all farms not connected.....	2.03	3.59	2.66	1.79	1.61
Equipment:					
Electric pump - have now.....	301	221	76	1	3
Mechanical refrigerator - have now..	289	222	66	-	1
" " - need.....	109	63	44	2	-
Electric stove - have now.....	58	50	8	-	-
" " - need.....	11	9	2	-	-
With:					
Would invest in:					
\$500 Lighting system.....	366	227	131	4	4
\$250 " " 	184	140	43	1	-
\$500 Power line.....	470	254	204	7	5
\$250 " " 	205	116	83	2	4

ADDITIONAL SURVEY DATA FOR KENTUCKY

State Supervisor: James B. Kelley, University of Kentucky, Lexington
Fayette County: John B. Trice
Hardin County: L. C. Huffman
Shelby County: W. T. Miller

Statistical data similar to those on the preceding page are given for each district in the three counties, together with county summaries.

The report also contains:

List of power plants in the state, with capacities, location, and ownership.

Descriptions of transmission and distribution lines in Fayette and Hardin Counties.

A list and description of proposed extension.

Names and power consumption of dairy farmers in Fayette County by townships.

List of all dairymen in Fayette County, with locations.

Rate schedules and extension policies.

Map and table showing farm types and characteristics in state.

About 100 pages of tables and maps giving the relative importance of farm enterprises in each county of the state.

State map showing transmission lines and power plants.

County maps of Fayette, Hardin, and Shelby Counties showing present and proposed farm lines and customers.

TABLE X

MARYLAND

Total number of farms in the state (1930): 43,203
 Total number of farms in the area surveyed: 6,184
 Counties included: Caroline, Carroll, and Talbot.

<u>Data from Rural Electrification Survey</u>	Existing	Proposed Extensions		
Farm customers.....	1,628	684		
Total rural customers.....	2,034	826		
Total miles of distribution lines serving rural customers.....	444.5	196.85		
Rural customers per mile.....	4.57	4.19		
Number of proposed extensions.....				
	No.	Kwh. per yr.	No.	Kwh. per yr.
Different types of farms, and average power used per year:				
Dairy.....	433	1,246	183	1,078
Poultry.....	175	1,326	70	862
General.....	1,020	857	421	943
Other rural customers.....	406	668	142	626

	Total	White		Non-white	
		Owner	Non-owner	Owner	Non-owner
<u>Data from Farm Housing Survey</u>					
Number of farm houses in area surveyed.	7,558	4,092	2,531	286	649
Average number of rooms in house.....	8.33	8.76	8.98	5.31	5.36
Average number of regular occupants....	4.38	4.01	4.72	4.22	4.89
Central station electric service.....	1,628	1,217	386	14	11
Home electric plants.....	390	293	91	-	6
Power line needed.....	956	556	367	13	20
Average number of miles to power line for all farms not connected.....	1.97	1.83	1.86	2.23	2.24
Equipment:					
Electric pump - have now.....	887				
Mechanical refrigerator - have now...	299	255	44	-	-
" " - need.....	139	112	26	1	-
Electric stove - have now.....	111	100	10	1	-
" " - need.....	42	35	7	-	-
With: <u>Would invest in:</u>					
\$500 Lighting system.....	885	520	331	11	23
\$250 " " 	435	251	172	2	10
\$500 Power line.....	573	329	233	4	7
\$250 " " 	306	177	117	7	5

ADDITIONAL SURVEY DATA FOR MARYLAND

State Supervisor: A. V. Krewatch, University of Maryland, College Park

Data in addition to the tabulation include:

Description of agriculture, soils and crops of the state, with per capita farm wealth and types of farms by counties.

List of power companies serving the state.

Rural electrification tabular data by districts for surveyed counties.

Power company rate schedules and line extension policies for the state.

Typical power consumption records by months for one year on 59 farms in different sections of the state.

List of road types on which farms are located, by counties.

Table giving number of farms with electric service in 1930, by counties.

Power distribution maps of Eastern Shore Public Service Co. and Consolidated Gas Electric Light & Power Co. of Baltimore.

State map showing forested areas.

County maps of Caroline, Carroll, and Talbot Counties showing present and proposed distribution lines and prospective customers.

MASSACHUSETTS

State Supervisor: C. I. Gunness, Massachusetts State College, Amherst.

Surveys are under way in Barnstable, Bristol, Essex, Norfolk and Plymouth Counties and are being completed as a state project. Completion date has been set for August 1, 1934.

MICHIGAN

State Supervisor: H. J. Gallagher, Michigan State College, East Lansing.
 Clinton County: Burr Foster
 Macomb County: E. C. Perrine

Statistics submitted for the State of Michigan give data by companies as of May 1934. The data includes: total farms, farms served, other rural customers, miles of farm lines, voltage, average yearly farm consumption, average kilowatt-hour cost, rates and extension policies. The report includes no information on prospective lines or customers or rural electrification statistics by counties which could be tabulated.

A general summary for the state describes three agricultural divisions of the state and the electric service in each. Brief descriptions are given of the territory of each serving company, with information regarding generating facilities, total and farm sales. There are approximately 300 miles of municipal rural lines in the state, serving 1884 farm customers, and 9800 miles of private rural lines serving 37,004 farm customers. A description is also given of the Michigan State College educational extension program in rural electrification and its results. The report also includes a state map locating the franchise areas of the different companies.

County reports contain rate schedules and line extension policies with descriptions of the territory and some statistical data by companies and for the county; also distribution line maps of each county. Visits were made to 151 out of 3581 farms in the two counties and counts made of household and general electrical equipment in use. The following figures are taken from the estimated summary.

Total farms in two counties . . . 3581

<u>Equipment Used</u>	<u>No. Farms</u>
1. Iron	3030
2. Radio	2652
3. Washing machine	2495
4. Yard lights	2353
5. Toaster	2039
6. Vacuum sweeper	1584
7. 1/4 hp. motors	1494
8. Water systems	1339

TABLE XI

MINNESOTA

Total number of farms in the state (1930): 185,255
 Total number of farms in the area surveyed: 4,404
 Counties included: Blue Earth and Stevens Counties.

<u>Data from Rural Electrification Survey</u>	Existing		Proposed Extensions	
	No.	Kwh. per yr.	No.	Kwh. per yr.
Farm customers.....	300		885	
Total rural customers.....	329		937	
Total miles of distribution lines serving rural customers.....	114.8		302.45	
Rural customers per mile.....	2.86		3.1	
Number of proposed extensions.....			28	
Different types of farms, and average power used per year:				
Dairy.....	168	655	343	652
Poultry.....	5	430	1	550
General.....	127	550	541	550
Other rural customers.....	35	705	52	303

<u>Data from Farm Housing Survey</u>	Total	White		Non-white	
		Owner	Non-owner	Owner	Non-owner
Number of farm houses in area surveyed	4,254	2,325	1,929		
Average number of rooms in house.....	6.56	6.88	5.64		
Average number of regular occupants...	4.85	4.87	4.83		
Central station electric service.....	300	205	95		
Home electric plants.....	397	313	85		
Power line needed.....	113	61	52		
Average number of miles to power line for all farms not connected.....	3.54	3.4	3.63		
Equipment:					
Electric pump - have now.....	187	146	41		
Mechanical refrigerator - have now..	43	36	7		
" " - need.....	19	14	5		
Electric stove - have now.....	17	16	1		
" " - need.....	-	-	-		
With:					
\$500					
Would invest in:					
Lighting system.....	173	107	66		
\$250					
" " 	76	48	28		
\$500					
Power line.....	140	90	50		
\$250					
" " 	58	35	23		

ADDITIONAL SURVEY DATA FOR MINNESOTA

State Supervisor: H. B. White, University Farm, Minneapolis.
Blue Earth County: Ernest H. Schmidt.
Stevens County: Axel G. Sidenblad.

In addition to the statistical summary given, the report includes:

Estimated statistical summary for the entire state.

Map showing percent of rural houses wired, by counties.

Description of types of farming in state with map giving locations.

Descriptions of transmission and distribution lines in the surveyed counties.

List of proposed new lines in Blue Earth County in the order of feasibility, with descriptions of the lines and territory.

County maps showing existing and proposed rural lines and giving descriptions of lines and locations of present and prospective customers. (A 6600 volt iron wire line is in use in Stevens County.)

Statistics for the two surveyed counties by townships.

TABLE XII
MISSISSIPPI

Total number of farms in the state (1930): 312,663
Total number of farms in the area surveyed: 7,577
Counties included: Kemper and Lafayette Counties.

Data from Rural Electrification Survey		Existing		Proposed Extensions	
Farm customers.....		8		324	
Total rural customers.....		39		444	
Total miles of distribution lines serving rural customers.....		2		127	
Rural customers per mile.....		19.5		3.49	
Number of proposed extensions.....				11	
Different types of farms, and average power used per year:		No.	Kwh. per yr.	No.	Kwh. per yr.
Dairy.....		3	280	12	742.5
Poultry.....		18	300	4	200
General.....		4	170	340	500.5
Other rural customers.....		14	1,800	92	1,541.6

Data from Farm Housing Survey		Total	White		Non-white	
			Owner	Non-owner	Owner	Non-owner
Number of farm houses in area surveyed		4,984	1,469	1,195	401	1,919
Average number of rooms in house.....		3.88	5.19	3.91	4.33	2.86
Average number of regular occupants...		4.75	4.27	4.48	5.42	2.07
Central station electric service.....		-	-	-	-	-
Home electric plants.....		36	30	4	-	2
Power line needed.....		31	29	2	-	-
Average number of miles to power line for all farms not connected.....		18.6	19.6	20.5	16.6	?
Equipment:						
Electric pump - have now.....		6	1			
Mechanical refrigerator - have now..		13	13	-	-	-
" " - need.....		90	76	14	-	-
Electric stove - have now.....		-	-	-	-	-
" " - need.....		35	24	3	1	7
With: Would invest in:						
\$500	Lighting system.....	229	165	46	11	7
\$250	" "	107	76	24	6	1
\$500	Power line.....	62	36	18	4	4
\$250	" "	61	40	18	2	1

ADDITIONAL SURVEY DATA FOR MISSISSIPPI

State Supervisor: W. C. Howell, Mississippi State College, State College.
Kemper County: E. R. Arnold.
Lafayette County: F. E. Edwards.

Brief county reports give:

Descriptions of topography, agriculture, power lines and stations.

Proposed extensions classified, rated, and described.

Statistical information for each county by districts, each containing several townships.

County maps showing present and proposed distribution lines and possible new customers.

Engineers state that "rural population is very enthusiastic over prospects of receiving electric current and they are willing to cooperate in every way to get power."

It is estimated that 35.9 miles of rural lines in Kemper County would serve 135 customers with an estimated annual consumption of 73,135 kwh.

TABLE XIII

MISSOURI

Total number of farms in the state (1930): 255,940
 Total number of farms in the area surveyed: 4,733
 Counties included: Lawrence and Ralls

<u>Data from Rural Electrification Survey</u>	<u>Existing</u>		<u>Proposed Extensions</u>	
	No.	Kwh. per yr.	No.	Kwh. per yr.
Farm customers.....	334		600	
Total rural customers.....	417		672	
Total miles of distribution lines serving rural customers.....	122.1		115.7	
Rural customers per mile.....	3.4		5.8	
Number of proposed extensions.....			49	
Different types of farms, and average power used per year:				
Dairy.....	66	1,545	100	1,565
Poultry.....	1	6,386	1	1,200
General.....	123	1,054	315	843
Fruit.....	111	1,035	97	993
Other rural customers.....	83	859	67	552

<u>Data from Farm Housing Survey</u>	<u>Total</u>	<u>White</u>		<u>Non-white</u>	
		<u>Owner</u>	<u>Non-owner</u>	<u>Owner</u>	<u>Non-owner</u>
Number of farm houses in area surveyed	5,072	3,041	1,989	13	29
Average number of rooms in house.....	5.5	5.9	5.2	3.18	4.2
Average number of regular occupants...	4.1	4.0	4.3	3.23	3.7
Central station electric service.....	346	269	76	1	-
Home electric plants.....	142	117	25	-	-
Power line needed.....	71	56	14	1	-
Average number of miles to power line for all farms not connected.....	2.8	2.46	2.9	2.75	2.78
Equipment:					
Electric pump - have now.....	84	84	-	-	-
Mechanical refrigerator - have now..	71	58	13	-	-
" - need.....	45	33	12	-	-
Electric stove - have now.....	21	17	4	-	-
" - need.....	22	17	5	-	-
With: Would invest in:					
\$500 Lighting system.....	310	182	127	-	1
\$250 " 	107	66	41	-	-
\$500 Power line.....	239	173	65	-	1
\$250 " 	62	45	17	-	-

ADDITIONAL SURVEY DATA FOR MISSOURI

State Supervisor: M. M. Jones, University of Missouri, Columbia:
 Lawrence County: W. H. Crouch.
 Ralls County: D. V. Fette

The survey material from Missouri included a brief state report, a report on prospects in southwest Missouri, and county reports for five counties. Reports from Buchanan, Jackson, and Jefferson Counties are incomplete and could not be included in the tabular summary.

The state report describes farming in the state by areas and gives maps of farm types, real estate values, mortgages on owner operated farms, and amounts of mortgage debts. Brief statistical data for rural electrification surveys made by utility companies in 1929 and 1930 are included, together with an outline map giving the number of rural customers and total pole miles of lines by districts. There were 31 privately owned companies and 38 municipal plants in the state in 1930, 2299 and 284 pole miles of line having 4.9 and 4.2 customers per mile respectively. Southwest Missouri seems to be the most likely place for development, but the prospects are poor everywhere in the state until either farm incomes increase or electric costs decrease. The special report for southwest Missouri gives a brief description of prospects in Barry, Barton, Green, Jasper, Christian, Newton, Stone, McDonald, Taney, Dade, and Lawrence Counties.

County reports include:

- Data relative to present rural lines and costs. Distribution lines in Lawrence County are usually figured at \$700 per mile. Rates and extension policies.
- Lists and descriptions of proposed lines, possible customers, and construction problems. Names of individual farmers with size of houses and electrical appliances desired is given for each proposed extension in Jackson County.
- Classified lists of present rural customers by city centers, with the number of each and power consumption per year.
- Names of companies furnishing service.
- Statistical data for each county by townships. This data is only partial for Buchanan, Jackson, and Jefferson Counties.

TABLE XIV

NEBRASKA

Total number of farms in the state (1930): 129,458

Total number of farms in the area surveyed: 11,184

Counties included: Clay, Cuming, Dawson, Otoe, Scottsbluff, and Valley.

		Existing		Proposed Extensions		
<u>Data from Rural Electrification Survey</u>						
Farm customers.....		890		898		
Total rural customers.....		951		963		
Total miles of distribution lines serving rural customers.....		428.75		345.25		
Rural customers per mile.....		2.22		2.78		
Number of proposed extensions.....				61		
		No.	Kwh. per yr.	No.	Kwh. per yr.	
<u>Different types of farms, and average power used per year:</u>						
Dairy.....		39	2,145	5	3,614	
Poultry.....		26	1,000	2	1,000	
General.....		735	670	877	624	
Other rural customers.....		153	1,075	78	760	
		Total	White Owner Non-owner	Non-white Owner Non-owner		
<u>Data from Farm Housing Survey</u>						
Number of farm houses in area surveyed		11,110	4,936	6,086	7	81
Average number of rooms in house.....		5.9	6.5	5.5	4.6	3.1
Average number of regular occupants...		4.7	4.3	4.6	8.6	6.16
Central station electric service.....		648	459	188	-	1
Home electric plants.....		1,412	1,006	406	-	-
Power line needed.....		936	411	524	-	1
Average number of miles to power line for all farms not connected.....		2.95	3.1	2.85		
Equipment:						
Electric pump - have now.....		858	687	171		
Mechanical refrigerator - have now...		345	257	88		
" " - need.....		258	141	117		
Electric stove - have now.....		113	95	18		
" " - need.....		59	25	34		
<u>With:</u>						
Would invest in:						
\$500	Lighting system.....	619	286	333		
\$250	" "	306	144	162		
\$500	Power line.....	719	350	368	-	1
\$250	" "	309	140	169		

ADDITIONAL SURVEY DATA FOR NEBRASKA

State Supervisors: E. E. Brackett and E. B. Lewis, University of
Nebraska, Lincoln.

Scottsbluff County: Wayne K. Harrison

Clay County and Hastings District: Frank Simmons

Dawson County and Holdrege District: Harlen Cooper

Cuming County: E. N. Hansen

Otoe County: R. L. King

Valley County: P. A. Rasmussen

Holt County and Madison and Fairbury Districts: O. S. Cooper

Grand Island and Tecumseh Districts: E. E. Brackett and E. B. Lewis.

A brief state report tells of the density of farm population, percentage of tenancy, and the corresponding development of rural service. Fifteen private companies, 70 municipal plants, and the U. S. Reclamation Service serve the state. About two-fifths of the towns have their own distribution systems. Recent legislation encourages publicly owned power developments and prohibits a service charge in connection with rural rates.

County reports include:

Maps showing present and proposed distribution lines and present and prospective customers.

Names of companies serving the territory, with brief descriptions of the areas served and the service lines.

Lists of proposed rural lines, giving lengths, number of customers, estimated use of power, and the feasibility ranking.

Rate schedules and extension policies in effect.

Present farm lines in Scottsbluff County are described and information given on construction problems for new lines. U. S. Reclamation Service lines are being built at about \$700 per mile, exclusive of transformers and using 18 poles per mile and 3 No. 1 bare copper wires.

A municipal farm line from Morrill has a rate based on an annual minimum of 720 kwh. at \$81 payable in equal monthly installments.

TABLE XV

NEW HAMPSHIRE

Total number of farms in the state (1930): 14,906
 Total number of farms in the area surveyed: 1,997
 Counties included: Merrimack

Data from Rural Electrification Survey	Existing		Proposed Extensions	
	No.	Kwh. per yr.	No.	Kwh. per yr.
Farm customers.....	1045		Not Available	
Total rural customers.....	Not Available		"	"
Total miles of distribution lines serving farm customers.....	354		"	"
Farm customers per mile.....	3		"	"
Number of proposed extensions.....	Not Available		"	"
Different types of farms, and average power used per year:				
Dairy.....	470	600	Unknown	
Poultry.....	175	600	"	
General.....	400	600	"	
Other rural customers.....	No Information Available			

Data from Farm Housing Survey	Total	White		Non-white	
		Owner	Non-owner	Owner	Non-owner
Number of farm houses in area surveyed	2040	1731	309	None	
Average number of rooms in house.....	8.5	8.5	8.4	"	
Average number of regular occupants...	4.2	4.02	4.4	"	
Central station electric service.....	1045	909	136	"	
Home electric plants.....	41	30	11	"	
Power line needed.....	3	2	1	"	
Average number of miles to power line for all farms not connected.....	.9	.9	.9	"	
Equipment:					
Electric pump - have now.....	168	163	5	"	
Mechanical refrigerator - have now..	137	117	20	"	
" - need.....	3	2	1	"	
Electric stove - have now.....	37	31	6	"	
" - need.....				"	
With: Would invest in:					
\$500 Lighting system.....	88	77	11	"	
\$250 " 	62	55	7	"	
\$500 Power line.....	90	73	17	"	
\$250 " 	75	63	12	"	

NEW HAMPSHIRE

State Supervisor: W. T. Ackerman, University of New Hampshire, Durham.
Assistants: R. G. Clark and W. A. Smith.

The New Hampshire report gives statistical data on existing rural lines in Merrimack County, by townships. Data on proposed lines are not given.

Present and proposed lines in Merrimack County are plotted on U.S.G.S. maps of the area. There is a total length of 354 miles of distribution lines now in existence. Present rural service is mostly two wire 2300 volt single phase with about 40 poles per mile. Roads are winding and the country is hilly and rocky.

TABLE XVI
NORTH CAROLINA

Total number of farms in the state (1930): 279,708
Total number of farms in the area surveyed: 8,667
Counties included: Cleveland, Edgecomb, and Moore. (partial)

		Existing		Proposed Extensions		
<u>Data from Rural Electrification Survey</u>						
Farm customers.....		722		748		
Total rural customers.....		947		1,063		
Total miles of distribution lines serving rural customers.....		259		277.3		
Rural customers per mile.....		3.65		3.8		
Number of proposed extensions.....				71		
		No.	Kwh.	No.	Kwh	
		per yr.		per yr.		
Different types of farms, and average power used per year;						
Dairy.....		26	1,560	9	630	
Poultry.....		15	1,020	30	900	
General.....		663	286	570	543	
Other rural customers.....		289	926	167	845	
		White		Non-white		
		Total	Owner	Non-owner	Owner	Non-owner
<u>Data from Farm Housing Survey</u>						
Number of farm houses in area surveyed		8,774	2,447	2,700	381	3,246
Average number of rooms in house.....		4.7	5.6	4.77	4.4	3.8
Average number of regular occupants...		5.5	5.2	5.4	5.8	6.17
Central station electric service.....		722	443	247	8	24
Home electric plants.....		218	128	34	5	51
Power line needed.....		1,744	750	714	57	223
Average number of miles to power line for all farms not connected.....		2.4	2.28	1.9	1.95	2.0
Equipment:						
Electric pump - have now.....						
Mechanical refrigerator - have now..		185	158	19	8	-
" " - need.....		169	150	19	-	-
Electric stove - have now.....		30	24	6	-	-
" " - need.....		17	16	1	-	-
With:						
Would invest in:						
\$500	Lighting system.....	1,050	392	397	24	237
\$250	" " 	541	211	218	13	99
\$500	Power line.....	1,089	553	332	83	121
\$250	" " 	624	371	189	19	45

ADDITIONAL SURVEY DATA FOR NORTH CAROLINA

State Supervisor: D. S. Weaver, State College, Raleigh.
 Cleveland County:
 Edgecomb County:
 Moore County:

Reports for each county include:

- A county map with present and proposed distribution lines and existing transmission lines and generating stations plotted.
- Statistical reports for each county by townships.
- A table giving descriptions of existing farm lines and location on the map.
- A table of proposed rural lines, giving lengths, number of prospective farm and other customers, soil conditions, and whether connection charges must be paid. These lines are rated in the order of feasibility.
- A description of transmission lines, with their locations.
- Notes on rates and line extension policies.

A report on the state as a whole includes:

- A list of counties by districts, giving the type of agriculture in each county, the percentage of homes using electricity, the extent of use of present service, the possibilities of extending rural service, the probable extent of use of service by new customers, and possible supporting industries. The most likely districts for development are noted and reasons given.
- List of electric power companies and the counties served.
- Company line extension plans.
- List of municipally owned generating plants and distribution systems.
- Map showing locations of municipal systems.
- A summary of comments on rural electrification from the seven C.W.A. Farm Housing Survey reports by counties.
- Descriptions of two rural lines 3.7 and 5 miles long built as C.W.A. projects and acclaimed by county administrators as their most valuable C.W.A. projects.
- A tabulation of data on rural electrification supplied by 146 teachers of vocational agriculture in the state. Fifty-eight teachers said that groups of farmers were considering the securing of electric service. One hundred twenty-five teachers thought that groups of farmers could be organized to extend lines cooperatively.

The survey is being continued and expanded as a state relief program. It is to be followed by line construction.

OHIO

State Supervisor: I. P. Blauser, Ohio State University, Columbus.
Ashland County: Tod L. Deibler.
Darke County: Claude E. Craig.
Sandusky County:

Surveys in each of the three counties were limited to one township. Housing survey figures for these townships are given. Estimates for proposed new lines and customers are incomplete.

County maps give the locations of present transmission and distribution lines and power stations and proposed lines on which information was obtained.

The survey was conducted by visiting farms. Engineers report interest in rural service, but doubt whether many farmers would have sufficient funds at present to pay the 2 percent minimum monthly guarantee.

Information for the state as a whole includes:

Estimated state statistical summary.
General comments on rural development and prospects in the state.
State map showing percentage of farms in each county having central station service.
1930 Census data pertaining to rural electrification by counties.
List of power companies serving the state, with the counties in which they serve.
Ohio extension policy.
Rate schedules of private and municipal utilities.

TABLE XVII

OKLAHOMA

Total number of farms in the state (1930): 203,866
 Total number of farms in the area surveyed: 7,194
 Counties included: Garfield and Pittsburgh. (partial)

Data from Rural Electrification Survey		Existing	Proposed Extensions			
Farm customers.....		78		354		
Total rural customers.....		170		417		
Total miles of distribution lines serving rural customers.....		33.3		68		
Rural customers per mile.....		5.1		6.13		
Number of proposed extensions.....				15		
		No.	Kwh. per yr.	No.	Kwh. per yr.	
Different types of farms, and average power used per year:						
	Dairy.....	6	4,083	2	2,000	
	Poultry.....	1	4,600	1	200	
	General.....	69	628	351	782	
Other rural customers.....		93	1,484	63	838	
		Total	White Owner Non-owner	Non-white Owner Non-owner		
Data from Farm Housing Survey						
Number of farm houses in area surveyed		5,236	2,024	3,002	115	95
Average number of rooms in house.....		4.62	5.26	4.28	4.05	3.29
Average number of regular occupants...		4.46	4.04	4.62	4.85	4.91
Central station electric service.....		169	128	41	-	-
Home electric plants.....		152	117	33	2	-
Power line needed.....		4	3	1	-	-
Average number of miles to power line for all farms not connected.....		3.66	2.86	3.99	4.22	4.59
Equipment:						
Electric pump - have now.....						
Mechanical refrigerator - have now..		79	56	18	1	4
" " - need.....		56	21	33	-	2
Electric stove - have now.....		15	14	1	-	-
" " - need.....						
With: Would invest in:						
\$500	Lighting system.....	208	121	86	1	-
\$250	" "	26	17	8	-	1
\$500	Power line.....	84	48	35	1	-
\$250	" "	11	5	6	-	-

ADDITIONAL SURVEY DATA FOR OKLAHOMA

State Supervisor: C. V. Phagan, Oklahoma A. & M. College, Stillwater.
 Garfield County: John L. Huston
 Pittsburg County: L. R. Hallock

A brief state report gives the following:

Types of farming, by counties.
 1930 Census data on rural electrification, by counties.
 Comments on the possibilities of extending rural service.
 Questionnaires mailed to users in 1932 asking for comments
 119 replies received. 67 percent were complaints on high
 cost of service of which 61 percent mentioned the high
 service charge. Most of the complaints were from small
 users.
 A state map indicating the most likely localities for rural
 development.
 A 135-page bulletin on Rural Electrification in Oklahoma in 1932

County reports included:

County maps with existing and proposed farm lines and existing
 transmission lines located. Map of Garfield County also locates
 all prospective customers on existing and proposed extensions.
 Lists of existing distribution lines with descriptions.
 Lists of proposed distribution lines giving length, possible
 farm and other customers, and comments on feasibility.
 Rates and extension policies in effect.
 Statistical tabulations from survey by townships.
 Comments on rights of way, soil conditions for pole setting,
 tree trimming necessary, state laws affecting cooperatives,
 and adequacy of existing sources of power.

OREGON

State Supervisor, F. E. Price, Oregon State Agricultural College,
Corvallis.

The rural electrification survey was undertaken in the following counties and areas:

Clackamas County
Josephine "
Jackson "
Deschutes "
Tripp "
Gilliam "
Sherman "
A section of the Willamette Valley.

None of the reports have been submitted.

SOUTH CAROLINA

South Carolina was not included in the National Rural Electrification Survey because of an extensive survey of a similar nature which had just been completed by the State. (Survey of Rural Electrification in South Carolina, by A. R. Wellwood and Others, 1933, 152 pp. South Carolina State Highway Dept., Columbia.)

The following information is extracted from the state report.

Ninety-seven "project sections" involving 4,887 prospective consumers and 972.5 miles of line were surveyed in detail by the Highway Commission. An additional 343 project districts were surveyed by the farm agents of Clemson College Extension Service late in 1932. These additional projects include 11,952 possible customers on 3,803.4 miles of line. This makes a total of 16,839 possible new customers on 4,775.9 miles of line. The customers per mile range from 2.9 to 10.9 on the different projects, with an average of 3.52 per mile. The average annual consumption per customer is estimated at 962 kwh., representing all classes of service except highway lighting.

The plan of the development is to combine the lighting of certain sections of the highways by the state with rural distribution of power, the enterprise to be self-sustaining from revenues. The state would buy power at wholesale at various points on existing lines and act as distributor to individual consumers.

At the time the plan was under discussion, hearings were held, and 129 communities applied for electric service.

The report gives details of the economics of the plan, costs, rates, estimated returns, growth, etc.

One section of the report deals with highway lighting and beacons; another with the "Social and Economic Desirability of Rural Electrification" and another with "Public Interest and Popular Demand for Rural Electrification in South Carolina."

Maps show the locations and extent of electric project sections and present public utility districts.

TABLE XVIII

SOUTH DAKOTA

Total number of farms in the state (1930): 83,157
 Total number of farms in the area surveyed: 4,069
 Counties included: Beadle and Brookings.

<u>Data from Rural Electrification Survey</u>		Existing	Proposed Extensions
Farm customers.....		77	1,010
Total rural customers.....		80	1,050
Total miles of distribution lines serving rural customers.....		28.95	320.15
Rural customers per mile.....		2.76	3.27
Number of proposed extensions.....			21

Different types of farms, and average power used per year:		No.	Kwh. per yr.	No.	Kwh. per yr.
Dairy.....		7	696	241	1,799
Poultry.....		4	1,200	-	-
General.....		62	488	769	1,617
Other rural customers.....		3	1,333	39	405

<u>Data from Farm Housing Survey</u>	Total	White		Non-white	
		Owner	Non-owner	Owner	Non-owner
Number of farm houses in area surveyed	3,661	1,450	2,211		
Average number of rooms in house.....	6.33	6.51	6.21		
Average number of regular occupants...	4.67	4.51	4.73		
Central station electric service.....	94	45	49		
Home electric plants.....	373	240	133		
Power line needed.....	1,366	463	903		
Average number of miles to power line for all farms not connected.....	4.66	4.15	4.09		
Equipment:					
Electric pump - have now.....	6	1	5		
Mechanical refrigerator - have now..	56	39	17		
" " - need.....	1,531	557	974		
Electric stove - have now.....	10	7	3		
" " - need.....	276	94	182		
With: Would invest in:					
\$500 Lighting system.....	325	136	189		
\$250 " "	105	42	63		
\$500 Power line.....	199	82	117		
\$250 " "	48	12	36		

ADDITIONAL SURVEY DATA FOR SOUTH DAKOTA

State Supervisor: R. L. Patty, South Dakota State College, Brookings.

Beadle County: Harry W. Leonhardt.

Brookings County: Delbert Taute.

General report includes:

Comments on rural development and prospects in state. Beadle and Brookings Counties are typical of 43 counties in eastern section of state. Western section has little prospect for electric service at present.

State map showing prospects for rural electrification based on owner-operated farms, value of dairy and livestock products, and grain crops, and number of farms per mile.

State map showing 1934 power lines of different utilities.

List of power companies operating in the state.

Number of rural customers and present use in state.

A tabular summary of farm rates.

Copies of letters from 8 to 11 companies in state giving prospects for rural development and new lines in their territory.

County reports include:

Statistical survey summary for each township.

General description of county agriculture.

Description of existing lines and power facilities.

List of proposed rural extensions, giving length, number of possible customers, and estimated annual consumption.

Discussion of feasibility of proposed line extensions.

TABLE XIX

TEXAS

Total number of farms in the state (1930): 495,489

Total number of farms in the area surveyed: 7,788

Counties included: Bexar (partial) and Hidalgo.

Data from Rural Electrification Survey		Existing		Proposed Extensions		
Farm customers.....		724		415		
Total rural customers.....		1,476		632		
Total miles of distribution lines serving rural customers.....		358.18		102.45		
Rural customers per mile.....		4.12		6.17		
Number of proposed extensions.....				29		
		No.	Kwh. per yr.	No.	Kwh. per yr.	
Different types of farms, and average power used per year:						
Dairy.....		81	5,450	38	6,160	
Poultry.....		28	1,430	38	1,036	
General.....		308	1,255	222	877	
Fruit.....		577	816	111	879	
Other rural customers.....		467	851	217	730	
		White		Non-white		
		Total	Owner Non-owner	Owner Non-owner		
Data from Farm Housing Survey						
Number of farm houses in area surveyed	3,490	1,945	1,049	95	401	
Average number of rooms in house.....	4.27	4.73	4.06	3.66	2.96	
Average number of regular occupants...	4.21	3.82	4.37	4.84	5.68	
Central station electric service.....	720	534	176	4	6	
Home electric plants.....	230	202	25	1	2	
Power line needed.....	327	194	114	5	14	
Average number of miles to power line for all farms not connected.....	2.02	1.72	1.87	3.58	2.42	
Equipment:						
Electric pump - have now.....	150					
Mechanical refrigerator - have now..	335	289	46	-	-	
" " - need.....	54	50	4	-	-	
Electric stove - have now.....	207	174	32	1	-	
" " - need.....	14	13	1	-	-	
With:	Would invest in:					
\$500	Lighting system.....	435	266	150	6	13
\$250	" "	177	113	60	-	4
\$500	Power line.....	358	218	126	6	8
\$250	" "	167	95	64	3	5

ADDITIONAL SURVEY DATA FOR TEXAS

Supervising Engineers: Dan Scoates and J. B. Atkinson, Texas A. & M.
College, College Station.

Bexar County: Robert Specht

Dallas County:

Hidalgo County:

The statistical summary for Texas includes all of Hidalgo County and 17 out of 49 districts in Bexar County. Additional data are given for Bexar and Dallas Counties but are not complete.

The county reports contain:

Statistical data by districts. (Housing survey data are complete for Bexar County, but rural electrification survey data are missing for 32 districts. Complete statistics are given for 4 districts in Dallas County.)

List and descriptions of existing transmission and distribution lines (Bexar and Hidalgo)

Description of construction problems, soils, tree trimming, etc. (Lines are being built 15 ft. back of property line to avoid palm trees.)

Extension policies.

Rate schedules.

Maps showing existing transmission and distribution lines, proposed line extensions and possible customers on new lines.

A rating list for proposed extensions.

The report for Dallas County is given by power company districts. It includes two private and one municipal company.

A classified list of customers giving the number of customers and power consumption for each community in one district of Dallas County.

Additional data for the state include:

A summary of all Farm Housing Survey data pertaining to rural electrification, by counties and also state totals.

Brief description of transmission lines in the state.

A list of counties most in need of rural power development, giving number of farms, present miles of lines and area of county.

Notes on rural rates and extension policies of different utilities.

VIRGINIA

State Supervisors: Chas. E. Seitz and B. B. Potter, Virginia Polytechnic Institute, Blacksburg.

Field Engineers: G. K. Harnsberger, Wm. A. Fowler, Jr., R. A. Gouldin, F. L. Bocock and R. L. Mohler.

The Virginia survey was organized to obtain as much data as possible from a relatively large area within the limit of time and funds available, and to complete the survey on funds from some other source at a later date.

The report submitted covers 44 of the 100 counties in the state, containing 2/3 to 3/4 of the rural lines in the state.

Maps of the 44 counties were submitted, with present transmission and distribution lines plotted on them.

The bound report for the state contains:

Map showing the areas surveyed.

List of counties, giving the status of the survey in each.

Statistical data on rural electrification by power company service areas.

Statistical data on rural electrification by counties within company service areas. Data includes miles of distribution and transmission lines, number of customers, classification of types of farms where available, and Housing Survey data from counties in which that survey was made.

Rates and extension policies in force in the state.

Notes on poles, soil conditions, etc.

Average span lengths of rural lines in eastern Virginia is 350 to 400 ft. and in the hilly sections of the western part of the state, 175 to 200 ft.

The Virginia Survey is being continued. Final reports should be available this fall.

WASHINGTON

State Supervisor: L. J. Smith, Washington State College, Pullman.

Surveys were started in Adams, Lewis, Snohomish and Yakima Counties.

A partial report for Adams County was submitted giving notes on the agriculture of the county, the farms using electricity, an estimate of possible future development of the county, including changes in the type of agriculture and estimates of electricity consumption.

Reports are to be submitted later.

An effort is being made to continue and expand the survey as a Washington relief project.

TABLE XX

WISCONSIN

Total number of farms in the state (1930): 181,767
 Total number of farms in the area surveyed: 11,210
 Counties included: Calumet, Dane, Richland, Walworth, and Washburn Counties

Data from Rural Electrification Survey		Existing	Proposed Extensions			
Farm customers.....		3,847	4,029*			
Total rural customers.....		4,482	4,748			
Total miles of distribution lines serving rural customers.....		1,168.9	1,073			
Rural customers per mile.....		3.92	4.42			
		No.	Kwh. per yr.	No.	Kwh. per yr.	
Different types of farms, and average power used per year:						
	Dairy.....	2,912	637	3,152	606	
	Poultry.....	541	565	351	573	
	General.....	789	324	614	339	
	Farm crops.....	918	300	811	300	
Other rural customers.....		534	192	1,441	132	
		Total	White Owner	White Non-owner	Non-white Owner	Non-white owner
Data from Farm Housing Survey						
Number of farm houses in area surveyed		9,103	6,192	2,911		
Average number of rooms in house.....		7.14	7.26	7.01		
Average number of regular occupants...		4.77	4.74	4.75		
Central station electric service.....		3,020	2,225	795		
Home electric plants.....		712	580	132		
Power line needed.....		7,801	4,846	2,955		
Average number of miles to power line for all farms not connected.....		1.26	1.23	1.28		
Equipment:						
Electric pump - have now.....		1,064	804	260		
Mechanical refrigerator - have now..		283	219	64		
" " - need.....		146	97	49		
Electric stove - have now.....		244	227	17		
" " - need.....		38	36	2		
With:	Would invest in:					
\$500	Lighting system.....	224	164	60		
\$250	" "	107	84	23		
\$500	Power line.....	579	353	126		
\$250	" "	276	165	111		

* Also 1325 additional prospective customers on existing lines.

ADDITIONAL SURVEY DATA FOR WISCONSIN

State Supervisors: S. A. Witzel and P. B. Eves, University of
Wisconsin, Madison.

Calumet County:

Dane County: P. B. Eves

Richland County: Ronald F. Ferguson

Walworth County: Chas. A. Eberle

Waushara County:

Field and office assistants: M. A. Stockley, Miss L. Webb, and
Miss E. Doering.

County reports submitted include:

County maps showing present and proposed distribution lines and
present transmission lines and generating stations.

Large scale township plats for each county, with proposed line
extensions plotted to scale.

General description of methods of collecting data.

Notes on each county, the percentage of farms which might be
served, acreage and tenancy, sources of farm incomes, land
utilization, and percentage of farms having various modern
conveniences.

Rates and extension policies in effect.

What Will Help Rural Electrification Most.

In answer to the question "what are the most promising things which can be done to aid farmers in getting electric service in your state?", ten of the state survey supervisors gave these replies.

<u>No. Favoring</u>	<u>Method</u>
7	Lower line construction costs or connection charges. Give farmers opportunity to build lines. Three supervisors placed lower line costs first.
6	Educational work with farmers and farm women by educational agencies and utilities.
4	Increase the farm income or purchasing power of the farmer's dollar. Three placed this first.
4	Lower the cost of appliances and equipment.
4	Reasonable and uniform rates.
3	Good will rates or rates which will encourage use.
2	Lower minimum bills. Apply annual in place of monthly minimum.
2	Financing for lines, wiring, and equipment purchases.
2	Educate utilities in use of electricity on farms.
1	Uniform extension policies.
1	Lower wiring costs. Teach farmer to help.

The following men supplied the above information: E. W. Lehmann, Illinois; T. E. Henton, Indiana; F. C. Fenton, Kansas; A. V. Krewatch, Maryland; H. H. Musselman, Michigan; H. B. White, Minnesota; M. M. Jones, Missouri; E. E. Brackett, Nebraska; I. P. Blauser, Ohio; and L. J. Smith, Washington.

Other Facts on Rural Electrification in the United States

Statistics. Electric service to farms of the United States is indicated statistically in Table 21. The group of figures in the first six columns gives the status of rural electrification at the time of the 1930 U. S. Census. At that time, 10.3 percent of the farms had central station service, and 4.0 percent had individual lighting plants. The average annual power consumption per farm varied from 198 kwh. in Arkansas to 15,868 kwh. in Arizona, and the average annual bill paid to the power companies ranged from \$37.60 in Utah to \$251.00 in Arizona. Relatively few motors were used in the south-central group of states. On the Pacific Coast and in the Southwest there was extensive use of motors, with accompanying larger power consumption and lower average rates. The use of motors is indicative of a farm power load in distinction to a load made up largely of lighting and domestic appliances.

On the Pacific Coast the power load consists mostly of pumping for irrigation and drainage, with some increment in heat and power for fruit, nut, and hop driers.

In the states of California and Arizona where irrigation by pumping prevails, the average annual power consumption per farm was 14,792 kwh. at a cost of about 1.45 cents per kwh. In the group of West South Central, Mountain, and Pacific states the average annual consumption was 7080 kwh. costing approximately 1.76 cents per kwh., while the average for the remainder of the United States was only 746 kwh. per year per farm, and the cost about 8.17 cents per kwh. These figures, while not exact, give a very good idea of the relation of large use to low unit costs.

The last four columns in Table 21 show the present development of electricity on farms and the increases in the ten years just past. It is significant to note that the percentage of farms receiving central station service increased from 2.8 to 11.3 in ten years, but that there are still nearly eight times as many farms without service as with it.

The map, Fig. 2, presents graphically the distribution of farms having central station service on December 31, 1933. It places the heavy percentages of farms in the North Atlantic and Pacific Coast sections and in Utah. The eastern development is due probably to the large number of industrial cities and towns with their inter-city distribution network, and to the proximity of rural users. Both factors tend to reduce the cost of bringing the service to the farm. On the Pacific Coast, service has been extended to farms largely because of the farm use for power, and independent of other industries. This power load is a most effective stimulant to rural service. It is an income-producing use for the farmer, insures a load worth building a line to serve, and permits lower rates which are attractive to the user.

Table 21

STATISTICS ON RURAL ELECTRIFICATION IN THE UNITED STATES, BY STATES

State	Number of all farms 1930	Farms served 1930	Kw-hrs. per farm 1930	Average bill per customer 1929	Number of farms using motors 1930*	Number of individ- ual plants 1930	Farms served		Percent of total farms served	
	*	*	*	*	*	*	Dec. 31, 1923 **	Dec. 31 1933 ***	Dec. 31, 1923 **	Dec. 31 1933 ***
Total United States	6,288,648	649,919			256,663	249,342	177,561	710,642	2.8	11.3
Maine	39,006	12,001	488	\$45.60	3,447	1,854	5,676	13,534	11.3	34.8
New Hampshire	14,906	5,658	550	61.20	1,561	996	2,396	7,401	11.4	49.6
Vermont	24,898	6,986	586	51.75	2,358	1,054	2,384	7,891	8.6	31.3
Massachusetts	25,598	14,088	1,012	76.00	4,266	2,057	2,440	14,422	7.3	56.3
Rhode Island	3,322	1,811	616	95.20	646	241	400	1,982	10.2	59.7
Connecticut	17,195	8,452	586	84.10	2,514	1,200	2,626	9,084	11.3	52.9
Total New England	124,925	48,996	684	65.50	14,792	7,402	15,922	54,314	10.1	43.5
New York	159,806	47,147	623	63.80	16,012	10,272	16,000	52,424	8.5	32.8
New Jersey	25,378	11,212	737	83.90	4,102	2,459	1,000	12,414	3.4	49.0
Pennsylvania	172,419	37,983	803	61.50	12,197	10,357	12,918	43,150	6.5	25.0
Total Middle Atlantic	357,603	96,342	706	65.50	32,311	23,088	29,819	107,988	7.1	30.2
Ohio	219,296	43,242	782	51.20	14,000	16,377	16,803	46,638	6.6	21.2
Indiana	181,570	20,503	617	48.90	7,795	11,579	3,228	23,065	1.6	12.7
Illinois	214,497	22,699	743	65.00	10,452	15,206	2,201	26,891	1.0	12.5
Michigan	169,372	29,869	710	51.60	10,285	8,895	2,996	39,110	1.6	23.1
Wisconsin	181,767	34,800	891	69.20	22,812	14,815	7,429	37,558	3.9	20.7
Total East No. Central	966,502	151,113	774	57.20	65,344	66,872	32,657	173,262	3.1	17.9
Minnesota	185,255	13,121	730	68.90	11,721	10,740	3,339	13,869	1.8	7.5
Iowa	214,928	29,634	687	64.50	17,277	19,976	11,237	31,475	5.3	14.6
Missouri	255,940	14,418	789	48.20	3,580	7,568	2,913	16,725	1.1	6.6
North Dakota	77,975	1,711	783	86.90	3,203	4,426	114	1,836	0.2	2.4
South Dakota	83,157	2,846	723	71.90	3,283	6,465	483	2,936	0.6	3.5
Nebraska	129,458	8,960	841	74.60	5,807	13,276	790	9,534	0.6	7.3
Kansas	166,042	11,593	990	57.70	5,101	10,372	900	13,266	0.5	8.0
Total West No. Central	1,112,755	82,283	776	63.20	49,972	72,823	19,776	89,641	1.8	8.1
Delaware	9,707	1,163	895	87.00	384	441	105	1,318	1.0	13.6
Maryland and D. C.	43,307	6,680	886	71.60	2,564	2,869	1,000	7,148	2.0	16.5
Virginia	170,610	10,105	938	60.70	2,427	4,579	2,100	13,054	1.1	7.7
West Virginia	82,641	2,891	454	54.20	884	2,471	215	3,410	0.2	4.1
North Carolina	279,708	9,450	490	45.90	1,633	6,022	2,100	9,675	0.7	3.5
South Carolina	157,931	3,493	554	47.75	757	2,962	900	3,692	0.5	2.4
Georgia	255,598	4,372	833	57.70	968	3,895	137	6,206	0.1	2.4
Florida	58,966	4,385	920	78.30	1,592	2,143	353	5,018	0.6	8.6
Total South Atlantic	1,058,468	42,539	742	59.90	11,209	25,382	6,910	49,521	0.6	4.7
Kentucky	246,499	6,815	398	55.20	1,121	4,581	3,411	8,281	1.3	3.4
Tennessee	245,657	7,585	535	50.10	1,216	3,182	1,350	8,049	0.5	3.3
Alabama	257,395	12,001	895	51.00	678	1,343	1,000	12,445	0.4	4.8
Mississippi	312,663	3,548	1,538	74.10	494	2,305	500	3,136	0.2	1.0
Total East So. Central	1,062,214	29,949	753	55.00	3,509	11,411	6,261	31,911	0.6	3.0
Arkansas	242,334	3,202	198	115.00	1,059	2,196	500	2,914	0.2	1.2
Louisiana	161,445	2,218	5,173	123.50	510	2,225	275	2,843	0.2	1.7
Oklahoma	203,866	4,517	717	67.75	1,688	3,913	1,600	5,324	0.8	2.6
Texas	495,489	11,501	3,008	86.55	4,051	12,299	2,100	11,320	0.5	2.3
Total West So. Central	1,103,134	21,438	2,335	90.75	7,305	20,633	4,475	22,401	0.4	2.1
Montana	47,495	2,192	1,366	79.75	1,088	1,536	550	2,702	1.2	5.6
Idaho	41,674	12,126	1,932	62.60	4,406	1,353	5,050	12,468	12.5	29.9
Wyoming	16,011	476	1,234	103.00	315	677	280	520	1.8	3.2
Colorado	59,956	6,757	761	64.60	2,289	2,845	1,118	7,066	1.9	11.8
New Mexico	31,404	1,242	1,299	106.20	393	556	250	1,326	0.8	4.2
Arizona	14,173	3,805	15,868	251.00	1,427	228	225	4,905	2.1	34.6
Utah	27,159	15,062	853	37.60	1,269	1,224	3,330	15,858	12.9	58.5
Nevada	3,442	876	1,152	69.50	564	236	125	962	3.2	28.0
Total Mountain	241,314	42,536	2,596	71.40	11,751	8,655	10,928	45,807	4.6	19.0
Washington	70,904	33,803	2,675	63.50	10,751	3,800	13,400	37,069	18.3	52.3
Oregon	55,153	15,767	2,130	53.20	6,043	2,704	5,250	17,142	9.4	31.0
California	135,676	85,153	14,677	195.50	43,676	6,572	32,064	81,856	23.5	60.0
Total Pacific	261,733	134,723	9,250	147.50	60,470	13,076	50,714	135,797	20.3	52.0

*1930 U. S. Census

**N.E.L.A. Publication No. 237, August, 1932.

***Rural Electrification Exchange, No. 2, March 1, 1934, issued by Edison Electric Institute.

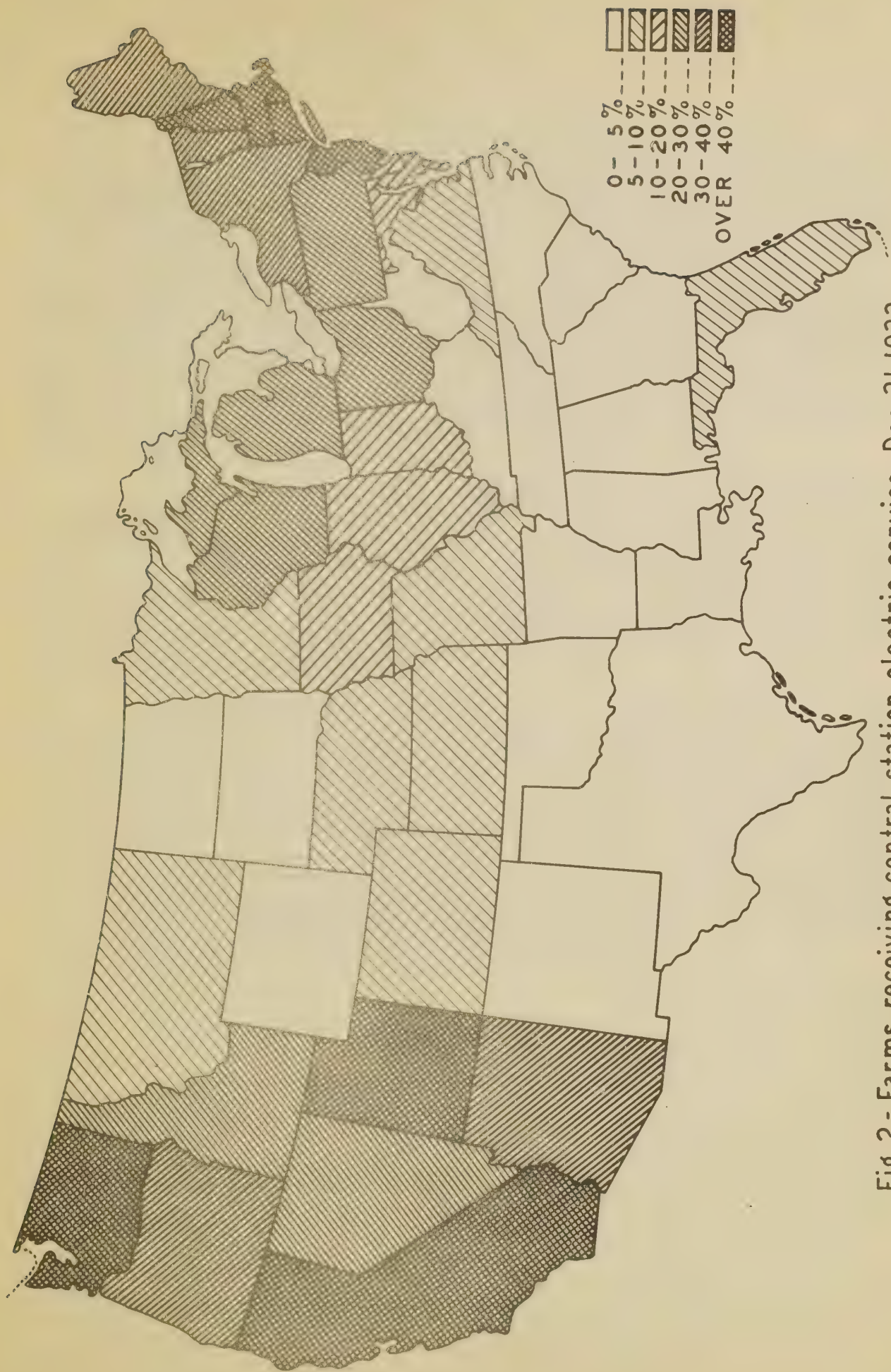


Fig.2 - Farms receiving central station electric service, Dec.31,1933

Farmers Want Electric Service. Prior to the World War, few farms in the United States had electric service from central stations. A genuine interest in electric service was evidenced by farmers, however, in their purchases of farm lighting plants. In 1917 there were more than 160 manufacturers of such plants in the United States, and the number was increasing. The War practically stopped the manufacture of individual plants. After the War there was a greater demand for central station service with its opportunities for the use of larger power units. The demand for this service was met reluctantly by most utility officials, because the farm load was undeveloped and unprofitable and consisted mostly of lighting and small domestic appliances. There were numerous complaints from farmers because of high construction and service costs and the high rural rates charged by the utilities.

Investigations and Educational Effort. In September 1923, an investigation was undertaken in Minnesota to determine the feasibility of farm service from the standpoint of both the farmer and the utility. In this investigation there was cooperation between the electric utilities, a group of farmers, and the State University. The experiment was given wide publicity. It focused attention on the possibilities of using electricity for many purposes other than lighting the farm, and in a manner which might result profitably to both the farmer and the utility.

In 1923 the National Committee on the Relation of Electricity to Agriculture (N.R.E.A.) was formed through the cooperative action of the American Farm Bureau Federation and the National Electric Light Association. The purpose of this committee was to gather and disseminate facts regarding farm electrification. Under the leadership of the National Committee, similar committees were organized in 25 states. It was the primary function of these state committees to organize and support an investigation program relating to the use of electricity in agriculture and to publish the information obtained. The responsibility for conducting the investigations was placed in the hands of officers of the state agricultural colleges or experiment stations.

At the present time there are very few active state committees on the relation of electricity to agriculture. Ten states are continuing to receive some financial support from utilities for investigational programs. An interest in problems of improving farm life through the use of electricity remains and is showing up in programs of investigation adopted and financed by the experiment stations.

Sales Efforts of Utilities. In 1930 approximately 1,000 rural service men were in the employ of power companies. Some of them were ex-county agricultural agents, or had been associated with rural electrification projects at the colleges. The majority had been transferred from some other branch of the utility organizations. Most of these men were connected to the sales departments of the utilities, but many of them devoted part or all of their time to educational work in promoting the use of electricity. During the past few years a large number of these men have been discharged or transferred to other duties. A few are now being returned to rural service work.

Publications on Electricity in Agriculture. Some 300 publications on many subjects relating to rural electrification have been issued by state and national Committees on the Relation of Electricity to Agriculture, the National Rural Electric Project, state experiment stations, agricultural extension service, utilities, and manufacturers. Two of the larger of these publications give a rather complete story of the development of uses for electricity on the farm and of research work under way. C.R.E.A. Bulletin Vol. VII No. 1* (332 pp.) gives experimental and use data on many applications of electricity on the farm and contains a partial bibliography of the more important publications. C.R.E.A. Bulletin, Vol. VI, No. 1* (79 pp.) describes briefly 211 C.R.E.A. investigations, 493 active projects in colleges, universities, and the United States Department of Agriculture related to rural electrification, 118 undertakings of an investigational nature by utilities and commercial concerns, and 39 investigations in private and other laboratories. Eighty-five suggestions for new studies are also included.

There have been listed 227 uses for electricity on the farm and 190 uses in rural industries. While these lists contain some duplications, they indicate something of the possible extent of the use of electricity in rural territory.

*Committee on the Relation of Electricity to Agriculture,
1120 Garland Building, Chicago.

Present Active Areas in Rural Electrical Development

The Map, Fig. 3, gives an approximate outline of the areas in which an active effort is being made to further develop rural service.

The areas marked (1) are those in which there have been educational efforts by the agricultural colleges and promotional work by the utilities. In the western states, the activity has been largely in the development of more productive uses for electricity. Some of California's irrigation pumping load has been lost to cheap natural gas, and to oil engines but efforts have been renewed in other directions. The middle western states are experiencing a slow but steady increase in use. There are relatively few productive and power uses on farms and rates are consequently higher than elsewhere. The North Atlantic section and Virginia have had active educational and sales campaigns for several years. Farms are closer together and rates are generally lower.

Michigan has led the country for several years in the number of farm customers added to those receiving service. The average farm rate (4.6¢ per kwh.) for 1932 is reported to be the lowest for any state east of the Mississippi River. The increase in customers served is due probably to the lower rates and the very excellent educational and development programs of the state agricultural college and the larger utilities.

North Carolina apparently has a very active interest in rural electrification emanating from the farmers. Several farm lines were built as C.W.A. projects. At present, a noteworthy committee appointed by Governor Ehringhaus is at work on the development of rural electric service in connection with the state's relief program.

South Carolina has made an extensive survey of rural electrification possibilities in the state and has enacted legislation "to establish a system of rural electrification under state control." The State Highway Department is constituted a State Board of Public Utilities and rural service is to be coordinated with highway lighting. Application has been made for a Public Works loan for rural line construction.

The Tennessee River Basin is to be supplied with cheap power by the Government. Power will be distributed by cooperative distribution organizations buying from the Government. Federal assistance is being given in educational and organization work, and as low interest loans for the purchase of equipment and appliances.

THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and change. It begins with the first settlers and continues through the present day.

The early years of the United States were marked by exploration and discovery. The first settlers came from Europe and brought with them the seeds of civilization. They built a new nation on a new continent.

The United States has grown from a small colony to a great nation. It has fought wars, won freedom, and built a great empire.

The United States is a land of opportunity. It is a land where anyone can make a better life for themselves.

The United States is a land of freedom. It is a land where everyone has the right to live as they see fit.

The United States is a land of hope. It is a land where the future is bright and the possibilities are endless.

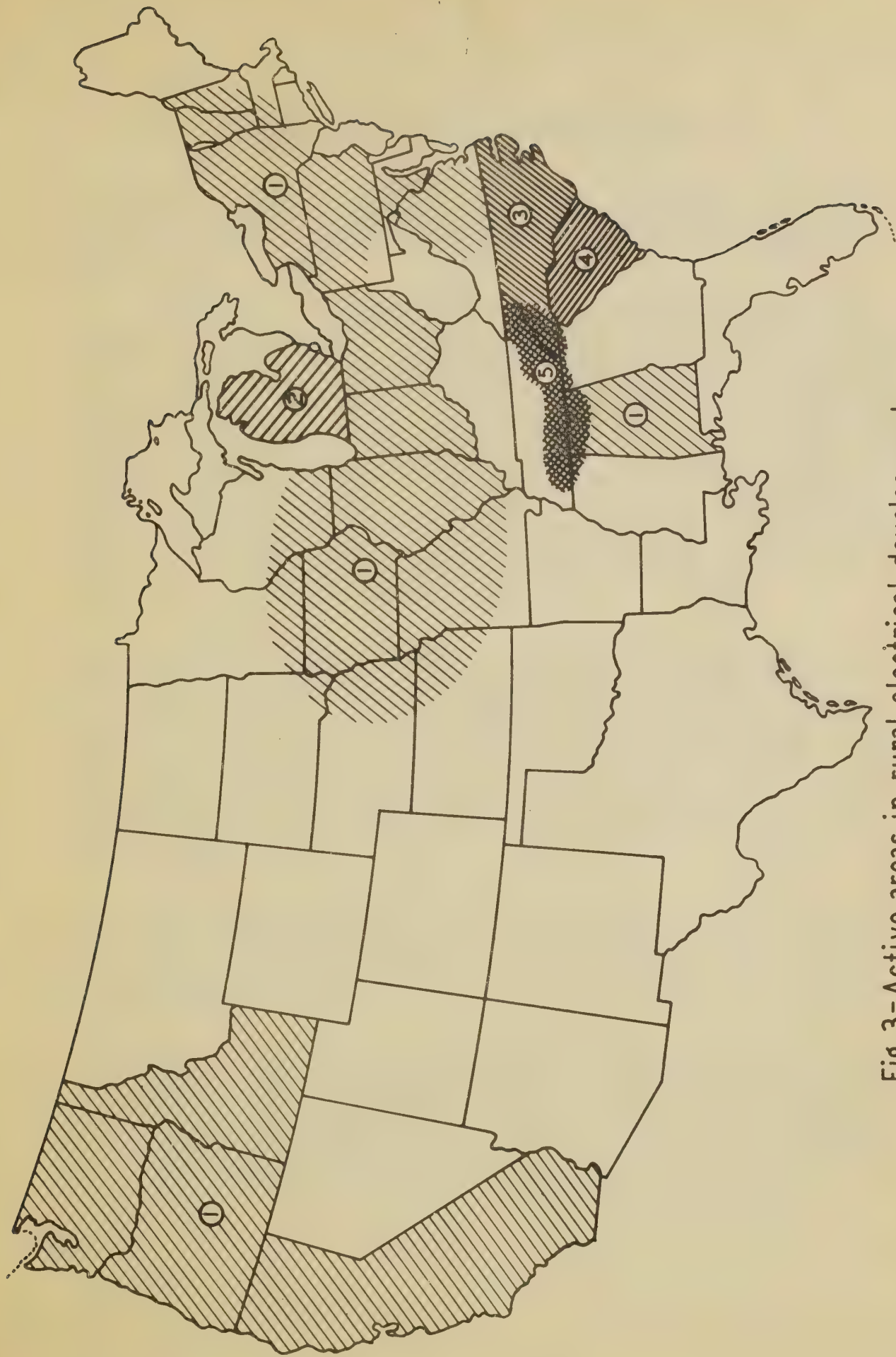


Fig. 3-Active areas in rural electrical development

Rural Developments in Foreign Countries

The information under this heading is indicative of the general trend and widespread interest in rural electrification throughout the world. It is not a complete record of foreign activities, nor is it entirely up-to-date.

Canada. Special encouragement has been given to rural electrification in the Province of Ontario. Power is generated and distributed by the Province. The provincial government assumes 50 percent of the cost of transmission lines, transformers, and distribution lines used in serving rural territory. Investments are tax free. Rates include a service charge and an energy charge. The monthly service charge increases with increasing demand. The energy charge is in two steps, and varies in different rural power districts, the lower step usually reaching 2 cents per kwh. Some rural rates in the United States are higher and some are lower than those in Ontario. The provincial government also has a Rural District Loan Act which provides funds to be loaned to farmers for the purchase of electrical equipment, repayment to be made in five years in monthly installments.

Australia and New Zealand. Several states in Australia have state electricity commissions which supply electricity to urban and rural residents and conduct investigations on the agricultural use of electricity. Farmers in both Australia and New Zealand are making extensive use of electricity, particularly in the dairy industry. Both countries in advertising for farm residents have placed especial emphasis on the availability of electricity as an agricultural asset. Power is generated and distributed by the Government or local power boards. In some instances these boards also assist with the financing of electric farm equipment purchases.

Farm uses for electricity in Europe include lights, and small power about the farmstead for root-slicing, chaff cutting, milling, separating, churning, and threshing. Switzerland, with its water power plants, leads all other countries in the percentage of homes receiving electric service.

Fifty percent of the farms in Denmark were reported as being electrified in 1932. Standards of living are higher, more farms are owned by the operators, and farming is more intensive in Denmark than in much of Europe. Electricity is supplied largely through cooperative associations, the government giving aid in only limited areas. Many of the generating stations are Diesel engine driven.

Finland has numerous water power plants. Most of them are financed cooperatively or by joint-stock companies. In 1925 slightly less than 40 percent of the farms had electric service.

In Belgium the British Department of Overseas Trade reported good progress was being made in rural electrification. In November 1931 there were only about 150 parishes not having an electricity supply, and nearly all the rural dwellings capable of being wired were at least provided with electric lights.

Italy has experimented with agricultural uses of electricity for over 35 years. In the valley of the Po, electricity is used extensively for reclamation, irrigation, threshing, and lesser power applications. Some electric plowing has been done with cable type outfits, and recently an electric tractor has been placed on the market. Since the war, the Italian government has offered subsidies to companies constructing power plants and distribution facilities to supply agricultural needs, and special subsidies for irrigation developments which would increase the acreage of crop land. Some progress has been made in investigational work and in cooperative organization for the distribution of electricity and purchase of electrical equipment.

In Germany, it has been estimated, 60 percent or more of the farm homes had central station electric service in 1927. There are numerous "power cooperatives" in Germany that buy electricity from government or private generating stations and distribute it to members. Before the war the government gave some aid through indirect subsidies in the form of cheaper credit than was extended to other organizations. Uses for electricity on farms are similar to those in the United States with the addition of threshing, more feed-preparing equipment, and machines used in distilleries. The English journal "Rural Electrification" reports that German companies have done "an enormous amount of constructional work" in the past few years.

Rural electrification in Sweden and Norway has attracted considerable attention in the United States largely because of the development of electric soil heating which had its inception in those countries. Many acres of land devoted to hotbeds and gardens are now electrically heated, some of the installations being well within the Arctic Circle.

Sweden's water power is in part developed by private enterprise and partly by the state. The Board of Waterfalls controls the state developments and aids with the utilization of the country's power resources. Rural distribution is effected by cooperative distribution societies. Distribution costs are financed by loans to the cooperatives from savings banks, etc. Rural electric development was rapid and a large part of the arable land is now electrified. It has been estimated that 50,000 grain threshers are driven by electric power. Seed cleaning, chaff cutting, cake crushing, milking, and separating are other common power uses.

France, with 36,000 communes, supports a population which is half rural. In 1927, 45 percent of the communes had electric service; in 1930, 71 percent were served. The state gives aid to electrification projects in four ways: (1) engineering and technical skill; (2) subsidies for construction; (3) remission of taxes to encourage private construction; (4) loans at low interest rates. The state also carries on an educational campaign to acquaint farmers with the value of using electricity. State subsidies may amount to 50 percent of the cost or more. Up to December, 1928, the state had distributed \$28,000,000 in such grants, which are under the control of the Rural Engineering Service of the Ministry of Agriculture. Subsidy allotments were increased in 1930 from 250,000,000 to 350,000,000 francs. In addition, 700,000,000 francs had been loaned up to November, 1929. Frequently the public utility is itself a syndicate of interested parishes.

Czechoslovakia has had a most interesting development of cooperative power distribution. Starting with a few small cooperatives prior to the war, about 70 percent of the population is now served. Some of the cooperatives buy power from private companies, some from the government, and some have their own generating facilities. The government grants subsidies of 50 to 75 percent of the cost of rural lines, legislates on maximum rate charges, remits taxes, and gives low rate loans to cooperatives. There are over 1,300 electrical cooperative societies. In a typical agricultural area in 1928 the average annual power consumption per person in the area was 150 kwh. Forty percent was used for light and 60 percent for power. Wiring costs per peasant holding are about \$375. The average current cost for light is 11¢ per kwh. and for power 6¢ per kwh.

Japan. In 1923 a Farm Electrification Society was organized in Japan with former Premier Kiyoura as honorary President and the former head of the Department of Agriculture as President. A campaign of education was initiated, experts being sent on tours through the country to lecture and demonstrate. Applications were similar to those in other countries, with special emphasis on threshing, drainage, and irrigation, and the addition of silk worm raising and rice hulling. Electricity is supplied by private companies whose development has been quite similar to that in the United States.

China. This country also has its rural electrification projects. Very interesting reports of experimental work, of an agricultural survey, and of farm uses for electricity have been issued by the Foochow Electric Co., Ltd. While the expenditure for power by residents of Kekung Village, which was reported, is small per patron, the expenditure represents a relatively large proportion of the patron's total cash income. Much attention is given by the company to the social and educational betterment of the community.

Summary. Rural electric development in Europe is more extensive and has been more rapid than in the United States. Most European governments have provided educational assistance and subsidies in one form or another. Cooperative organizations for the distribution of power have been encouraged, and perhaps over-stimulated in some instances. The state frequently owns power plants and sells power.

Rates charged for power range from 1¢ to 20¢ per kwh., which are comparable to rates in the United States. The service voltage in many countries is 220-380 instead of 115-230 as in the United States, with accompanying lower costs of distribution and increased costs for safety.

Motor applications are usually below 5 hp. except where a number of farmers cooperate in such operations as threshing, in which case 30 hp. motors are not uncommon. Electric threshing has been developed to a much greater extent in European countries than in the United States. Electric plowing with very large cable-drawn plows is being practiced to some extent in France, Germany, and Italy, and keen interest in field operations exists throughout Europe, whereas they have had little support in this country.

Assistance Given to Rural Electrification by Governments

	Canada (Ontario)	Australia	New Zealand	Denmark	Finland	Italy	Germany	Sweden	France	Japan	Czechoslovakia
Ownership of generating and/or distribution facilities: Private	X			X	X	X	X	X	X	X	X
Public	X	X	X	X	X	-	X	X	X	-	X
Cooperative users societies	X		X	X	X	X	X	X	X	-	X
Lines or plants subsidized	50%					X		-	50%		50%
Property tax-free	X					-			X	-	X
Low rate loans for construction of plants or lines	X		X			-	X	X	X	-	X
Loans to individuals for purchase of equipment	X		X			-				-	
Educational and experimental work	X	X	X		X	X	X	X	X	X	X

(Blank spaces indicate lack of information.)

Opportunities for Expanding Rural Service

Farmers generally want electric service. Many of those who do not now have it would have it if the cost were lower or if their cash income were larger. Many others would have it if they knew how to use electricity to increase the returns from their farming operations. In order to serve the others the many obstacles to that service must be removed. Each obstacle removed opens the possibilities of electricity to a new group of rural users, or permits the use of electricity for additional farm purposes. Opportunities for expansion involve the following factors:

Farm cash income.	Wiring costs
Rates and service charges.	Financing
Rate forms.	Supplemental rural industries.
Line construction costs.	Research
Line extension policies.	Education
Equipment and equipment costs.	Sales

The Farmer's Point of View. Whether a farmer asks for electric service or is being urged to buy it, he is a prospective customer. Customers today buy the things which are put up in attractive packages and offered at appealing prices. Too much of our electricity is offered in a "take it or leave it" package with labels which cannot be read or understood.

The farmer's position and viewpoint is different from that of the industrialist and different from the city domestic user. The selling approach to the farmer must also be different. It should be based upon the farmer's point of view--and be sure it is the farmer's actual viewpoint and not the one the utility thinks he should have.

Farm Cash Income. The farmer's expenditures must be adjusted to his relatively limited cash income. The barn is usually built before the house. The barn shelters horses and cows and feed for them; and the horses and cows add directly or indirectly to the farm income. The income from the cows builds the house. More attention should be given the income producing uses of electricity. They need more attention. They need demonstration, trial, and use in the community, with monthly net balances over costs. So far, the use of electricity for convenience and pleasure on farms has been largely an "about face" movement of the farmer--an "out of pocket" expense in place of an income producing investment.

Rates and Service Charges are universal obstacles to extended service. Lower them and use increases. Increase use, and charges can be lowered. Several means for lowering rural rates are possible with varying degrees of justification and satisfaction, including:

Service at city rates or on an area basis, all customers within the area being on the same base rate. Where farming sections are tributary to large cities or electricity-consuming centers, the farm rate may be materially lowered without imposing great burdens on the urban residents. As the rural consumption increases it will automatically carry its own costs. Indiana now has such an area rate basis by legislative enactment. A number of private utilities are finding that the stimulus to use justifies the change to area rates.

Subsidies, such as -

- Government grants for line construction or other properties.
- Tax exemptions.
- Low interest loans.

Wholesale purchases of power by farmers cooperative associations.

Any method of lowering rural rates is helpful in establishing or increasing the use of service. Some outside aid may be necessary at first. The ultimate solution of the rate problem, however, is the increasing of use by developing farm applications for electricity which will pay for themselves and yield a profit.

Under present conditions in purely rural areas there seems to be a need for levying a service charge in some form to pay the added cost of rural line construction and rural service. As, the farm load develops, the need for this service charge will gradually decrease and disappear. There is some evidence even now that the elimination of the rural service charge in certain areas, accompanied by educational activities, will increase revenues sufficiently to offset the charge.

Rate Forms are the packages in which electricity is sold. Some rural rates contain so many pages of provisions, complications, and options that only a trained rate engineer can understand the meaning of them. Other rural rates are so simple they may be printed completely in large type on a postal card. Both will produce approximately the same return per kilowatt-hour sold. One is a safety rate; the other a good-will rate. One breeds suspicion and distrust; the other understanding. One embodies all the many items of cost in proper sliding assemblies to protect the company from loss regardless of the quantity of electricity used by the consumer. The other enlists the confidence of the farmer through the use of understandable language.

Line Construction Costs. Most present rural distribution lines are urban lines transplanted in the country. They have resulted from precedent in urban practice rather than from fulfillment of an economic need of rural territory. Cost of line construction plays a much larger part in service costs in the country districts, where users are scattered, than it does in the city. Rural distribution costs are greater than the cost of generating the power distributed. They offer a likely place for research in rate reduction.

Some progress has been made by utilities in reducing line costs in recent years, mainly through longer spans between poles. The possibilities have not been exhausted. A return to farmer hauling and setting of poles might help.

Line Extension Policies have been greatly improved in recent years. With an increased Federal interest in rural service these policies may be further liberalized. The important thing is to consider extension assessments from the viewpoint of the farmer and his cash income, and endeavor to make their collection as light a burden as possible.

Equipment and Equipment Costs. There are three opportunities for fostering rural service in the equipment field:

- (1) Lower costs.
- (2) Better distribution.
- (3) Improved and new equipment which will produce a profit over costs of purchase and operation.

Electric equipment has been notoriously high in price. That it can be reduced is being demonstrated by the Electric Home and Farm Authority in the Tennessee Valley. There are still plenty of opportunities in this direction.

Another problem in electric service to the farm is to make available reliable equipment at a price within reach of the farmer. This applies more particularly to farm appliances such as brooders, grinders, and equipment for other than house use. These sales and service channels have not been adequately developed. Utility cooperation in sales seems to be essential.

Household electric devices are and will continue to be most important in creating a desire for electric service in rural areas. By far the vast majority of farms having service use it for lighting, a radio, domestic appliances, and possibly and automatic water system. These put the user in the 700 kwh. per year class, a consumption which is too low to be maintained in rural areas without either relatively high rates or some form of subsidy. There is a strong need for the development of more uses or equipment which will yield a profit over operating costs. Electricity now furnishes about 5.8 percent of the power used on farms. Electricity for heat, light, and direct application have scarcely been pioneered. The greatest possibility for service extensions and lower rates lies in this development field. This is amply demonstrated by the 15,000 kwh. average farm use in California and Arizona for such purposes as irrigation, dehydration, dairy and poultry appliances, with their accompanying low average cost of about 1.45 cents per kwh.

Wiring Costs. Farm wiring should be safe and adequate; safe because of the susceptibility of livestock to injury by stray currents and because of the inflammable nature of buildings in which the wires may be located; adequate because there is almost a certainty of increasing use, once service is installed. The cost of a safe and adequate wiring job done on union hours and wages and according to city standards is greater than any farmer can afford to pay, except a few of the most prosperous ones or city owners of farms. The result is either no wiring, inadequate wiring, or makeshift wiring.

The development of a simplified system of lower cost wiring for farms will be a step in the direction of bringing electric service within the reach of a new group of customers. It will make farm wiring safer by eliminating some of the unsafe extensions which are nailed up by the farmer himself because he does not have funds for a job engineered according to city standards.

If extensions of rural electric service are desirable either from the standpoint of improved standards of farm living or increased business for wiremen and manufacturers, authorities responsible for making up wiring regulations, manufacturers and contractors should give more attention to the liberalization of these regulations and simplification of plans to fit farm needs. At present there are 5,330,000 unwired farms and a half million others only partly wired, and no one is getting the business.

Farm requirements differ somewhat from city requirements. Ninety-five percent of the farm wiring is done in buildings now existing. An almost equally large percentage of city wiring is done in new buildings. There is the possibility of developing less expensive yet safe methods of wiring suitable for farm conditions. There is also the possibility of lowering the cost of wiring by furnishing to wiremen, particularly rural wiremen who are close enough to the job to understand farm economics, information concerning the most economical materials and methods that are now available.

Financing. Line construction, service leads, wiring and equipment all require financing when service is installed on a farm. All of these items are usually greater for farm service than for city service. Farm cash incomes are usually lower than city cash incomes. Prior to 1933 practically all financing of rural electrification was handled privately or through utilities or equipment distributors. The Government's Electric Home and Farm Authority is now making loans for the purchase of electrical equipment in certain sections of the Tennessee Valley. The Federal Housing Act program provides for a guarantee of 20 percent of private loans for house modernization, which will include wiring and some equipment purchases. Financing in some form is necessary to rural electrification. The greatest need is for financing to care for line construction and equipment costs. Perhaps the least burdensome and surest method of repayment of such loans is through amortized installments attached to monthly power bills. Line construction repayments may be further eased by substituting guaranteed minimum monthly or yearly revenues for direct cash payments.

Supplemental Rural Industries. Any industry which helps to share the cost of distribution in rural territory is a boon to rural electrification. Rural industries help both by sharing the cost of line construction and by offering slack season or full time employment to some members of the farm families. A cannery, creamery, cotton gin, dehydrator, grist mill, or small manufacturing plant may be the nucleus about which community electrification grows.

Research. The possibilities of reducing charges and extending service through increased use has been mentioned previously. The number of assured profit producing uses suited to the average farm is limited. Utilization methods which will produce a profit can only be discovered and demonstrated by continued research. The research should be directed to the aid of the farmer rather than the development of saleable equipment. Line construction, wiring installations, equipment or processes are subjects for research so long as they are not within the economic reach of the farmer. Additional research is anticipated by various governmental agencies. Most of the research work which has been done in the State experiment stations has been supported by contributions from utilities and manufacturers.

Education. Uses of electricity in the house for lighting and small appliances are pretty generally known and understood. As new applications for the use of electricity are evolved or adapted to a region, the prospective users must be informed of the possibilities if the use is to be extended. Viewed as a means of increasing the profits of the manufacturer and utility this is a sales enterprise. When so handled, the farmer, not having information on which to base an appraisal of the new machine or process, assumes the financial hazard of a trial. Salesmen usually are reimbursed on the basis of volume of sales. It is only natural that they should be better versed in sales methods than in economic analysis of the farmer's needs or the technicalities of proper installation. If the farmer needs help in the selection and proper application of fertilizers or spray materials, there is equal or greater need for assistance in the selection, adaptation and use of equipment such as milk coolers, sterilizers, hotbed heaters, etc., all of which affect the quality of products he offers to the public as well as the income he may make from his business.

Much of this educational work has been done and done effectively by utilities and manufacturers. Ordinarily the farmer does not look to these agencies to protect his interests. Perhaps the best example of increased use of electricity on farms and increased satisfaction from such use is to be found in the State of Michigan, where there has been a studied effort on the part of the Agricultural Extension Service to assist the farmers with rural electrification problems. This educational effort has been supplemented by commendable cooperation from the utilities.

Educational work should include an analysis of local and specific farm conditions to determine what electrical equipment and processes can be used advantageously. It should include studies of desirable changes in farm or home organization and management to make the best and most economical use of new and old electrical equipment. It is not sufficient to just sell a water system. With the water system should go information on where and how to place running water in the kitchen so it will save steps and heavy lifting. An electric brooder may produce only half the possible satisfaction if its sale is not accompanied or preceded by explanations and demonstrations of the differences in operation of the electric and other brooders previously used.

Sales. Power and equipment sales to farmers are only partially within the realm of the ordinary salesman. In so far as farmers have cash with which to purchase standardized domestic equipment appliances such as lights, radios, refrigerators and ranges, similar sales methods may be used as for any other domestic customer. High pressure methods are not adapted, however, to the sale of productive equipment such as milking machines, brooders, or cold storage plants. This calls for a salesman who knows the farm business as well or better than the farmer, and whose facts and information are basic rather than of the sales manual type.